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Editorial Notes.

The Retrospect of the World Fuel Conference.

To-day appears the fourth and final article of the series in which Dr. E. W. Smith and Mr. T. Campbell Finlayson have summarized for the gas industry the lessons of the recent World Power Conference on Fuel. In announcing these special articles in an Editorial Note on Oct. 31, we claimed to have secured the services of the two men whom we considered to be in the best position to contribute them; and our view was based upon the close connection which Dr. Smith and Mr. Finlayson had with the organization of the conference, and upon the fact that they are fuel technologists in a broad sense. Our faith in them—the articles were not in our possession when the previous note was written—has been fully confirmed; and our readers will agree that the ponderous subject-matter of a fortnight's deliberations has been pointed and underlined for the gas industry in a manner which displays remarkable introspection and breadth of view. To make a précis or abstract of the many papers, or groups of papers, which were discussed at the conference would, we think, have resulted in a disjointed and wearying tale; and the authors adopted the course of setting down what they consider to be the major problems confronting the industry at the present time; and on that foundation they have erected the very striking structure of their impressions of the meeting.

Rationalization.

Pride of place was accorded to rationalization; and let it be said at once that we are indebted to the authors for repeating a definition of the term, and for lucidly explaining what it may mean for the gas industry. The word "rationalization" is being bandied about nowadays almost as much as its predecessor "nationalization" was; and it is probable that not one-half those who use the words know what they signify. In the first article it was shown how the gas industry requires "to readjust its methods and organization to the changed conditions of to-day, in order to eliminate waste and attain the highest possible efficiency;" and its requirements were displayed in striking contrast to those of the coking and the electricity industries. For instance, large stations are necessary for the thermally efficient generation of electricity, whereas an efficient gas plant is built up of a number of similarly efficient small units. Hence the deduction of the opinion (which is widely held) that rationalization of the gas industry comprises, not centralization of manufacture at large stations, but joint working and inter-communication by a number of efficient works and undertakings. Stress is laid, however, on the advisability of actual centralization in one direction—that of bye-product ammonia recovery on the lines advocated by Mr. Parrish, by following which it is difficult to see, say Dr. Smith and Mr. Finlayson, how any synthetic producers can compete with us. This statement is the most heartening we have read for some time in reference to a somewhat dismal branch of the industry's activities; and developments are keenly awaited. In discussing the readjustment of methods in the industry, the warning is thrown out that even the young and healthy growth of research may be stunted through lack of rational application of its methods. "Too often is the research worker expected to apply the results of his work. Too often is the engineer expected to develop the details of his own process." Their work must be co-ordinated by scientific management.

Undoubtedly the industry can do a great deal towards putting its house in order; but it could do much more if the Government saw fit to grant it the legislative amendments for which it pleads so consistently.

Solid Smokeless Fuel.

In discussing the bearing of the conference upon the next of the gas industry's problems as set out by the authors, they point out that it is beyond dispute that a satisfactory solid smokeless fuel can be made by either high or low temperature carbonization. As for the high-temperature product, there is room for improvement in its quality as supplied in many places; and provided that its characteristics are beyond reproach, it may well be asked if too much importance is not laid upon ease of ignition in the open grate. It is absence of smoke which is being sought, so why employ paper and wood for fire lighting? Gas is the scientific medium. Again, is it right to attempt to suit the fuel to the grate, rather than the grate to the fuel? As for low-temperature methods, it seems that, as they develop, the promoters will have to face some re-adjustment of market values. The liquid products will find a level which is at present ill-defined; and as the demand grows for the raw material in the shape of cheap small coals, the latter will naturally call a higher price, and may eventually have to bear the full mining cost. In any case, there will be no room—indeed, no reason—for two distinct industries. The main object is the elimination of the 40 million tons of raw coal consumed annually in domestic appliances; and if this great ideal was achieved through low-temperature carbonization, then only the gas industry could deal with, and dispose of, the resulting large quantities of rich gas.

Industrial Gas.

The next plank added by Dr. Smith and Mr. Finlayson to the gas industry's platform was industrial gas sales; and the importance of that plank will be endorsed by all, but with regret that there seems to be no immediate prospect of being able to nail it down with complete freedom in the matter of differential charges. However, much can be done as things are; and the authors of the articles now under review claim that a clear lesson of the conference was "Make a bid for the industrial load." The lesson was in the main dictated through the medium of a paper by a group of representatives of the American Gas Association, who proudly pointed to the fact that though competition between gas and oil in America is fiercer than the rivalry of gas and electricity in this country, nevertheless gas is winning in the industrial lists. It is significant

that the American Gas Association has a Standing Committee on Industrial Gas, and that all its research work is confided to one large Company engaged in the manufacture of industrial furnaces. Here indeed is co-operation between two branches of the industry, and it is encouraged by the realization that the prosperity and growth of the industry depends upon the sale to large consumers of reliable, efficient, and cheap equipment—the return being sought in the sales of gas. Let our gas industry read, mark, learn, and inwardly digest the lesson, and satisfy itself that this matter of developing industrial sales is one not only for the large undertakings in whose districts part of the industrial load is so obvious as to be an easy prey, but for the industry as a whole.

If differential charges are accepted as equitable by the Government, and are made generally available by an amendment in legislation, then "there seems no reason why, for very large quantities at a good load factor, gas should not be obtainable at 3d. to 4d. per therm. Such a price would, it is suggested, revolutionize the whole subject of industrial gas."

Coke Oven Gas.

In reviewing these articles, it has so far not been difficult to select certain features upon which it is especially desirable to dwell; but to re-read the section devoted to surplus coke-oven gas (on Nov. 14) is to decide merely to commend it *in toto* to the careful consideration of all. To us it seems that Dr. Smith and Mr. Finlayson have treated the subject in a manner so rational and lucid as to invite the endorsement of the two great industries concerned, whose "future prosperity and harmonious relations depend mainly upon the degree to which they learn and study fundamental facts concerning each other's requirements. They treat the same raw material; they make, or can make, similar products; they both play an immensely important part in our national life. Their processes of manufacture are too much alike for them to develop with advantage in isolation. The Fuel Conference was yet another occasion at which the lesson was learned that the gas industry and the bye-product coking industry have everything to gain by co-operation."

Encouragement and Promise.

In the foregoing we have indicated what the authors consider to be the four outstanding lessons of the World Fuel Conference. In the final article to-day they deal with coal cleaning, a miscellany of important technical developments which emerged at the conference, and with the gas industry's contribution to smoke abatement; and in gas circles generally there will be agreement with their concluding remark that the message of the conference to the industry was one of encouragement and promise.

Gasholder Sheeting.

It would be difficult to find anyone more capable of dealing authoritatively with the subject of gasholders—the theme of his address as Chairman of the Society of British Gas Industries—than Mr. R. J. Milbourne. Every day the question of gasholder sheeting becomes of more moment; and we would say that, unless many of the lessons to be derived from Mr. Milbourne's address are quickly put into practice, the problem of gas storage will become one of grave anxiety to all those gas engineers who do not desire to shelve their responsibilities because everything "seems to be all right." The appearance of an old gasholder—thanks largely to the application of several layers of protective coating—cannot be taken as a criterion of its actual condition; and to-day there must be hundreds of gasholders the fate of which, failing detailed and continuous inspection, will very shortly hang in the balance. Prevention of possible disaster is infinitely preferable to magnanimous compensation following an accident. This is, of course, platitudinous; but it is sometimes by no means harmful to repeat a platitude. In this particular instance, our justification is to be found in recent happenings to ancient holders, to which reference was made in these columns only a week or two ago.

In no way do we flatter ourselves that we can criticize the findings of Mr. Milbourne, a man whose life's work has consisted largely of investigation of the many intricate problems of holder design and maintenance, and who, in his early days, was guided by one who himself was an eminent authority on the subject; but we do think that some good may accrue if we call attention to a few of the conclusions at which the Chairman of the Society of British Gas Industries has arrived. First of all, in regard to the sheeting of holders generally—*i.e.*, holders of the floating type—he points out that this, in addition to being the thinnest material used in the entire structure, is most subject to both external and internal deterioration; and consequently he advises a liberal addition to the thickness of gasholder sheeting in the original design, to allow for the effects of corrosion. Ordinarily, rolling mills supply sheets to a specified weight per square foot; and the nature of the rolling process is such that the edges of the sheets are apt to be thinner than the centre. But it is just at the riveted lap that corrosion exercises its worst effects; and, as the strength of a chain is equal to its weakest link, Mr. Milbourne urges that in future the weight of a sheet shall not be accepted as proof of thickness. To our mind, this is an argument which cannot be contested. As, of course, it is impossible for the rolling mills to provide the necessary thickness on the longitudinal edge without claiming an increase in the rolling margin, it is suggested that an allowance of 10 p.ct. in excess of the theoretical weight per square foot be allowed by the purchaser. This will add to first cost, but the extra expenditure will be a form of true economy. "The engineer who is always keen on obtaining the cheapest gasholder offered," observes Mr. Milbourne, "generally gets what he seeks, and then pays the difference in the long-run."

Mr. Milbourne's remarks on the effect of temperature in relation to corrosion are of great interest, as also is his suggestion that gasholder designers would be well advised to give careful consideration to reversal of the lap, so that the edges of the sheets may be readily available for inspection and painting from the outside. This departure from common practice was actually made, at the request of Mr. Andrew Wilson, the General Manager of the Australian Gas Light Company, in a holder recently constructed for that Company. Doubtless our readers will pay particular attention to Mr. Milbourne's recommendations regarding careful investigation of the actual conditions on the first signs of corrosion in the crown sheeting; for it is the latter which has to bear the greatest strain, and the bursting of which, in Mr. Milbourne's opinion, has been responsible for most of the disasters which have occurred to holders. It is for this reason that he deplores the patching of crowns to prevent leakage without in any way restoring the original strength of the sheeting.

What material is most suitable for gasholder sheeting? This is a question which has been discussed time after time, and still remains controversial. Mr. Milbourne considers in turn the merits of wrought iron, steel, "Armco" iron (which is 99·84 p.ct. pure iron, but which, alas, costs about twice as much as mild steel), and copper steel. Speaking of steel, he strongly urges all gas engineers not to accept the Bessemer variety, owing to its disconcerting variation in quality. In an interesting written communication which was contributed to the discussion which followed the address, Major Richard Miles, of Messrs. Newton Chambers & Co., Ltd., states that there may appear shortly a new metal—an "artificial" wrought iron—possessing the physical and chemical properties of the best old-fashioned puddled iron, and which may be sold at a favourable price. Of copper steel, Mr. Milbourne has a high opinion—for the following reasons. It corrodes less rapidly; the adherent dense hard rust which forms on copper steel is an efficient protector to the underlying metal; and paint is more adherent to copper steel than to ordinary mild steel exposed to weather conditions. This naturally leads the author to discuss paints and protective measures generally. A well-painted surface, he states, should last from three to six years according to local conditions or circumstances. It is a false economy to employ inferior paints which are deficient in lasting properties, for the cost of application is from four to five times the cost of the paint itself. Considerable attention is devoted to that most popular of gasholder paints, red lead; and it is mentioned that a point of great importance in the selection of red lead is fineness of sub-division—a

property which has a marked effect upon the appearance of the film and its protective qualities. In this connection our readers will be interested in an article on the Neill process for the manufacture of iron oxide for paints, published in later columns of our issue to-day. Here again the question of fineness of particle is of major import. Mr. Milbourne maintains that the whole question of the best paint for protecting metal against corrosion is in itself a subject for the earnest attention of research work, and demands a thorough and painstaking investigation into the merits of the various coverings obtainable and in use.

Before concluding this note, we may with advantage refer to the excellent observations of Mr. Milbourne on the subject of oil films, in which regard he acknowledges the pioneer work of Mr. E. F. Keable, the Engineer and Manager of the Gorleston and Southtown Gas Company, at whose works cross-battens faced with felt (illustrated in Mr. Milbourne's address) are employed to prevent the drifting of the oil from one side of the tank to the other under the action of the wind. Altogether, the address is an extremely important contribution to the study of a subject which should at present be exercising the minds of all gas engineers, particularly in view of the attitude of Æolus, who appears to be bent on destruction; and the industry as a whole owes a debt of gratitude to the sterling work of the author.

The "Thermo-XX Beam" Radiant.

THURSDAY last witnessed the introduction by Radiation Ltd. of a new gas-fire radiant. For many years the Chairman of this Company—Mr. H. James Yates—has had in view the possibility of modifying the quality of the energy emitted by the gas fire; and during recent years, in the Central Research Laboratories of the Company, an intensive research has been conducted into the therapeutic properties of the radiant energy emitted by various heating media, and more particularly by the gas fire. The special Research Committee of the Institution of Gas Engineers has recently been engaged independently on the employment of gas as a direct curative agent, and its first report was presented at the last Annual Meeting of the Institution. The work was then in its earliest stages; but even so Mr. H. D. Madden, at that time the President of the Institution, expressed the view that our industry might be on the verge of some great discoveries in the application of heating by gas. To our mind, one of the discoveries then foreshadowed has been made in the Laboratories of Messrs. Radiation Ltd.; and its practical application to domestic heating by gas was demonstrated last Thursday in the form of a new radiant appropriately named the "Beam," which was brought to the notice of many distinguished scientists and medical men during the period when the Public Health Congress was being held in London.

When we think of the millions of gas fires in use in the homes of this country alone, and of the growing popularity of gaseous heating generally throughout the Kingdom, we consider there is justification for suggesting that the new radiant will bring sunshine into every home, for it not only has a delightfully cheerful appearance—what may be termed without exaggeration a sunshine effect—but possesses in marked degree the pleasant and beneficial properties of the sun's rays. With its advent, every gas consumer may have in his home an artificial sun when the real sun is hidden behind a bank of clouds or a pall of smoke, or is gracing another hemisphere. Moreover, though we know that this new radiant is more costly to manufacture, it is to be marketed at the same price as the one at present in vogue, and is of such form and size as to be interchangeable with the present "Thermo XX" radiant. It is, perhaps, unnecessary for us to add that due consideration has been paid to the question of glare; there is complete absence of this in the new radiant.

The heat radiated from a fire fitted with the "Beam," though identical in quantity to that emitted by the ordinary gas fire, is far pleasanter and more comfortable in its effect. We know this from experience; and we will endeavour briefly to explain this remarkable phenomenon. There is a peculiar difference between the action of radiant energy of long wavelength on the skin and the effect of radiant energy of short wavelength. The former has a surface effect; whereas short-wave radiation is capable of penetrating the outer epidermis. Exposure of the body to an intense source of infra-red energy results in dry scorching. On the other hand, the energy of shorter wavelength, penetrating the outer layer of skin, acts on the nerve ends and excites sweating. This is either sensible or insensible—for purely practical considerations we prefer the latter—but in any case the moisture produced acts as a blanket against the infra-red rays. Consequently, with the new "Beam" radiant there is absence of dry scorching, yet an equally efficient, and much more comfortable, heating effect. The theory of the subject, and an account of the very clever piece of research which has been carried out at the Central Laboratory of Messrs. Radiation, will be found in later pages of our issue to-day.

Radiation Ltd. have long realized that the progress of a commercial enterprise such as theirs depends on the constant application of scientific principles. This, indeed, has for years been the spirit animating their entire work. They themselves have gained the fruits of their far-sighted policy; but it is true also that the gas industry as a whole, and the millions of consumers it serves, have benefited as a result of the vision shown by the appliance makers. On more than one occasion we have been pleased to record the improvements which Messrs. Radiation have effected in gas-consuming appliances of many kinds; and we take this opportunity of heralding a development which cannot but enhance the popularity of gaseous energy as a heating medium, and which may in time open up further avenues along which the gas industry may travel in its constant journey of ever-widening service to mankind.

The Benefit of a Change of Air.

THE idea that, in certain circumstances, where artificial heating is resorted to, flues are unnecessary in rooms intended for human occupation, is one to which we should not dream of subscribing. In fact, it requires very little imagination to enable one to realize the probable condition of the atmosphere of such a room when occupied by (say) four or five people for any length of time. One is inclined to wonder whether the flueless room, with electric heating, has ever been tried for a period and been found not wanting. It is well known that authorities on hygiene advocate the movement of air in a room, if healthy conditions are to be maintained; and we have sufficient faith in the majority of British architects to feel convinced that they will not avoid flues and chimneys altogether, but will continue to provide houses in which air change will be effected noiselessly, economically, and effectively. The most satisfactory means of ventilating apartments is by a chimney flue terminating above the ridge of the roof. This provides, every minute of the day and night, costless ventilation for the apartment.

In order to economize in building construction costs, many architects, in designing houses, have omitted the brick-built chimney flue, and have in some instances arranged for the products of combustion from a gas fire to be discharged into a cavity wall or into a small flue pipe terminating, only a few feet above the gas fire, in an air brick. In this case, when the wind is in certain directions the products of combustion from the gas fire are not conveyed from the room; and the British Commercial Gas Association, it will be remembered, recently issued a booklet, prepared by Mr. Walter Tapper, A.R.A. (President of the Royal Institute of British Architects), which gives information to architects on the economical construction of flues from gas fires. It is pointed out in this booklet that: "Existing bye-laws (based on natural laws) "enforce the correct construction of coal fire flues; and "these bye-laws are familiar to everyone connected with "building. At present there are no bye-laws relating "to the construction of gas fire flues; and there remains "some ambiguity regarding the natural laws which "govern their construction. The natural laws which "govern the construction of coal flues govern also the con- "struction of gas fire flues. There is, however, a funda- "mental difference between gas and coal as a fuel; and "this affects the size of the flues necessary. Coal pro- "duces soot—gas on the other hand is a clean fuel, and "in ventilating it the flue area can therefore be made

"much smaller than that of the coal fire." As to the claims of saving in cost, there is abundant testimony available as to the building economies effected when chimney flues are constructed for gas fires, as compared with those built for coal fires.

New President of the Institute of Fuel.

The Institute of Fuel has come into being at a time when there is much good work for it to do; and the proceedings so far give every promise that it will be done. In a matter of the utmost importance it has been peculiarly fortunate—that is to say, in its Presidents. The Founder President of the Institute, Lord Melchett, and the gentleman who has now been selected to succeed him, Sir David Milne-Watson, are both leaders in the matter of research such as it is the aim of the members to conduct; and their influence and their enthusiasm must prove of inestimable benefit in a movement which is vital to the country's welfare. There was full recognition of the importance of the work of the Institute on the occasion last week of the annual dinner, speeches at which are recorded in this issue.

Too Many Societies and Meetings?

One of the speakers after the dinner—Lieut.-Col. K. Edgecumbe, who is himself President of the Institution of Electrical Engineers—while recognizing the usefulness of the Institute of Fuel, expressed the view that one of the things upon which it deserves congratulation is the fact that it "has formed one organization out of two." This is an act which he clearly regarded as being equal in merit with that of the man who makes two blades of grass grow where one grew before. We would not care to go quite so far as Lieut.-Col. Edgcumbe, and declare that at the present time the formation of Technical Societies is very nearly a disease; but we are, just at this time, tempted to hold very much the same opinion with regard to the number of meetings. It is, to say the least, embarrassing to find ourselves week after week faced with three alternatives—*i.e.*, giving subscribers far more than they can possibly find time to read; whittling-down contributions to the preparation of which the authors have devoted much time and labour; or getting much behind-hand with the publication of the doings of the industry. The last-named is not really an alternative; for it is a course which we hold to be out of the question. Thus we are reduced to consideration of the first two methods of dealing with the situation; and if we combine both, we hope subscribers and authors will realize that our desire is not in any way to harm them, but merely to solve in the best manner possible what impresses itself upon us as an ever-growing problem.

Science and Practice Must Go Hand in Hand.

We heard a few days ago Prof. Arthur Smithells telling the members of the Society of British Gas Industries, at their Autumn General Meeting, when referring to a particular problem, that there has been a great growth of interest on the scientific side; and the result of this has been a tremendous advance of knowledge of the subject. The auguries, he concluded, are excellent; but science will always have to go hand in hand with practice, and the differences between one set of circumstances and another will always need to be fully recognized. In all this, of course, we see the value of Technical Societies. It is not, indeed, that which is questioned; but only their number. It would certainly be possible to have too few; for the problems facing science and industry are many. As the demands for specialized knowledge become greater, and the calls for research more pressing, it is obvious that additional facilities are essential for acquiring and disseminating information which is of value to persons interested.

A Three Days' Conference at the British Industries Fair.

While on the subject of the importance of Technical Associations, we would draw attention to the arrangements made for a three days' conference at the forthcoming British Industries Fair, Birmingham Section. This is being organized by Mr. John Terrace, as President of the Institution of Gas Engineers; and the dates fixed for it are Feb. 19, 20, and 21. Invitations to attend are to be extended to all members of the Institution of Gas Engineers, the Society of British Gas Industries, the National Gas Council, and the British Commercial Gas Association. In urging as many members of the Society of British Gas Industries as can possibly do so to attend, Mr. R. J. Milbourne expressed the opinion that it will be numerically the largest conference yet held in the interests of the gas industry. He added that Mr. Frank H. Jones (President of the "B.C.G.A.") will preside. Here is a conference which may be productive of a vast amount of good, and which must be productive of some. To those who are taking an active part in staging it, the thanks of the industry are due.

Fighting for the Lighting.

Many important points emerged from the meeting last week of the Society of British Gas Industries, whose Chairman of Council is Mr. R. J. Milbourne, who knows most of what there is to know in connection with gasholders. Upon this subject he had much valuable information to impart; but his observations were equally weighty upon a matter of vital interest to another section of the Society's members. Time and again in these columns, during the past few months, we have presented in the strongest terms the case for the retention of as much as possible of the lighting load. We know what gas can do; and we want to see gas doing it. One may concede a little additional convenience for electricity in certain circumstances. It is not much to grant, and gas can show advantages far outweighing it. This, however, is not the complete tale; and for the benefit of the industry Mr. Milbourne further unfolded it. Can anyone believe that if ever the electricians wrested the whole of the lighting load from gas, they would be satisfied with that? Not if the matter is given the consideration which it deserves. Rather is the truth with Mr. Milbourne, when he declares that in a large majority of homes the consumption of electricity for lighting alone is too small to make it commercially profitable for the electricity company to lay a service cable and maintain a supply, unless it has some prospects of increasing the consumption; and consequently the electricians are using all their persuasive powers, by advertising and personal calls, to induce the occupier to cook, heat, and light by electricity. "If they succeed," added Mr. Milbourne, "the gas industry will in a number of cases eventually lose the cooking and heating too." This is putting the matter so plainly that it can be misunderstood by no one. Mr. Milbourne is a firm believer in gas as an illuminant. Well would it be for the industry if there were more of his faith.

Institution Education Scheme.

In later columns of our issue to-day we publish an abstract of the Examiners' Report relating to the 1928 Examinations of the Institution of Gas Engineers in Gas Engineering and Gas Supply. With regard to the Ordinary and the Higher Grade Examinations in Gas Engineering, reference is made to the marked improvement in the drawings, diagrams, and sketches. This comes somewhat as a relief after what has been said on the subject in previous years. Our optimism, however, was quickly to be crushed, for we were soon to learn that, in Ordinary and Higher Grade Gas Supply, "there is still room for substantial improvement (in the sketches)." Too often the sketches are but a poor rehash of text-book illustrations, instead of being graphical expressions of the student's first-hand knowledge of the thing illustrated. The Examiners emphasize—not for the first time—that line sketches are desired. The details of a Dürer engraving do not gain for the candidates the praise to which the latter (in their innocence) may think they are entitled.

Gas Supply.

Fourteen theses were presented for the Diploma in Gas Engineering; nine were passed. Three candidates presented themselves for the Diploma Examination in Gas Supply; none satisfied the Examiners. The view of the latter is that the name "thesis" is rather a stumbling-block. It tends to encourage candidates to strain after originality, and to overlook the importance of presenting the chosen subject in a form worthy of a Diploma candidate, and showing a first-hand knowledge of it. The Education Committee stipulate only that the thesis shall show original thought, observation, and deduction—not necessarily original research work—and not simply a summary of information and results which have been altogether taken, or can be obtained, from text-books.

PERSONAL.

Mr. JAMES W. CAMPBELL, M.Sc., A.M.I.Mech.E., who was recently appointed Secretary of the Institution of Gas Engineers, was educated at the Manchester College of Technology, of which he holds the Diploma of Associate. He also holds the Degree of M.Sc., of the Manchester University. For many years he was Assistant to Dr. A. L. Mellanby, Professor of Mechanical Engineering at the Royal Technical College, Glasgow, not only in his teaching work, but also in his consulting practice and his many investigations into problems connected with motive power engineering. Mr. Campbell has rendered good service to the young engineers of the Manchester and Glasgow Districts, by taking part in the founding of students' sections of one of the leading Institutions. For twelve years he was the Hon. Secretary and Editor of the Transactions of the Scientific Society of the Royal Technical College, which is a progressive junior engineering society with a membership comprised of past and present students. In the war period Mr. Campbell took part in the work of the research on "The Coking Coals of Scotland," under Prof. Thomas Gray, and was also on the staff of the Clyde Anti-Submarine Committee. Since the war period the new Secretary has devoted himself to technical journalism, and was for some years on the Editorial Staff of "Engineering." We offer our congratulations to him on his appointment, and our good wishes for success in his new work.

Mr. RUDOLPH H. DUXBURY, who has been Gas Engineer and Manager of the Batley Corporation Gas Department for over nine years, has been appointed Engineer, Manager, and Secretary to the South Bank and Normanby Gas Company, near Middlesbrough. Mr. Duxbury will take up his new duties on Jan. 1.

Mr. R. W. EDWARDS, the Managing Director of the Aldershot Gas, Water, and District Lighting Company, has been elected Chairman of the Health Committee of the Aldershot Borough Council.

At a meeting of the Bolton Corporation Lighting Committee on Nov. 12, Alderman JOSEPH TAYLOR (of Messrs. Joseph Taylor (Saturators), Ltd.) was re-elected Chairman of the Committee for the ensuing year.

Mr. ALEXANDER MCDONALD, Manager to the Prestonpans and District Gas Company, Ltd., has had the distinction of being elected to three Councils in one week—viz., County Council, Town Council, and Parish Council. To the County Council he was elected unopposed, and to the Town and Parish Councils by large majorities.

Mr. CECIL GANDON has arrived back in Smyrna, where he will resume management of the Ottoman Gas Company's works. It will be remembered that Mr. KENNETH GANDON, his brother, who is Assistant to Mr. J. W. Buckley (Engineer and General Manager to the Hornsey Gas Company), was granted leave to superintend the Smyrna Station during his brother's absence. Mr. Kenneth Gandon is now on his way back to London.

Alderman A. WALL has been re-elected Chairman of the Buxton Gas Committee for the ensuing year. No change has been made in the constitution of the Committee.

OBITUARY.

FREDERICK G. COCKEY.

With sincere regret we reported in our issue of last week the passing of Mr. Frederick G. Cockey, which took place at his residence at Surbiton on Nov. 18.

In his early professional life Mr. Cockey became Engineer to the Newport (Isle of Wight) Gas Company, after he had served with his family's firm, Messrs. Cockey & Sons, the well-known gas plant manufacturers of Frome, Somerset. Later he became Engineer to the New Swindon Gas Company. From Swindon Mr. Cockey went as Gas Engineer first to Worcester and then to Shanghai, and was succeeded in the latter appointment by Mr. H. King Hiller.

On his return to England, deceased became General Manager of the Fulham Steel Works Company, constructional engineers, London. In September, 1908, he obtained the appointment by the Compagnie d'Eclairage de Bahia, of Chief Engineer of the gas-works, electric generating station, and tramways of that Company at Bahia, South America. Returning to England in 1911, he became a Director of the Gas Meter Company, of Kingsland Road, and on its subsequent amalgamation, in 1926, with Parkinson & Cowan, he left, and joined the Directorate of Smith Meters, Kennington Park Road, London. He was there at the time of his death.

Mr. Cockey's genius as a mechanical engineer had full scope during the long time he was engaged in the design and construction of gas meters; and when the Institution of Gas Engineers appointed a Committee, in conjunction with the Society of British Gas Industries, to inquire into the life of gas meters, Mr. Cockey, being a member of both bodies, was nominated to serve upon it.

The subject of this memoir was well known among gas engineering Freemasons, as he had passed the Worshipful Master's Chair of the Evening Star Lodge, No. 1719. He presided at its Jubilee celebrations in October, 1927, when a large concourse of members of the craft attended an Emergency Meeting in the Grand Temple of Freemasons' Hall, and afterwards dined together in the Connaught Rooms. W. Bro. Cockey then displayed in a marked degree those qualities which had endeared him to so many friends.

The last solemn rites were observed at the interment which took place on Thursday morning last at the Surbiton Cemetery, Marsh Lane. It was attended by a number of those who were privileged to enjoy Mr. Cockey's friendship, and included representatives of the various spheres of activity with which he had identified himself. Among those at the service were Messrs. Lewis Smith and Ernest Smith, Co-Directors of deceased in Smith Meters, Ltd.; E. A. Broadberry, Past-President of the Institution of Gas Engineers; Albert and Fred Potterton, of the Society of British Gas Industries, on the Council of which Mr. Cockey had served as Vice-Chairman; W.Bro. Rae P. Normand, the Secretary, and W.Bros. Walter T. Dunn and J. Fred Wicks, Past-Masters, of the Evening Star Lodge; and Mr. Clifford A. King, Managing Director of the "GAS JOURNAL."

Deceased leaves a widow and an unmarried daughter.

WILLIAM GEORGE BLAGDEN.

The news of the death, at Petersfield, on Nov. 17, of Mr. William George Blagden, at the age of 89 years, will be read with much regret by his many friends in the gas and chemical industries.

Mr. Blagden was born at Warmsworth, Yorkshire, in 1839. He was educated at University College, London, and later went to Liège University, and then to Freiburg University, securing Mining Engineering Degrees. His commercial activities commenced in 1862; and, at the time when he owned the works of Carless & Blagden (now Carless, Capel, & Leonard), he was probably the first maker of benzole in England. In 1870 he started business, as W. G. Blagden & Co., in the City of London; entering into partnership in 1872 under the title of Blagden & Angus. Upon the latter's retirement in 1883, he was joined by his son, Mr. Victor Blagden, the present Chairman of Victor Blagden & Co., Ltd. The last few years of Mr. W. G. Blagden's commercial life were spent with the Gas Light and Coke Company.

Besides his knowledge of chemical and engineering matters, he was a remarkable linguist, speaking four or five languages fluently. His passing breaks still another of the few remaining links with the pioneer days of the gas and chemical industries, in which he was an outstanding and highly respected personality.

The friends of Mr. J. N. REESON, who was formerly with the Gas Light and Coke Company, and left in 1913 to become Chief Engineer to the Metropolitan Gas Company of Melbourne, will join with us in expressing heartfelt sympathy with him in the loss he has sustained by the death of his only son, Dennis Owston, at the age of 32, which occurred at 3, Pasadena Mansions, St. Kilda Road, Melbourne, on Nov. 19.

It is with regret we have to announce the death of Mr. H. S. SMITH-REWSE, who was Vice-Chairman and a Director of the Whessoe Foundry and Engineering Company, Ltd., of Darlington. For over forty years he has represented, in London, the Whessoe Company, and was well known to many of our readers. There are but few gas engineers, especially in the neighbourhood of London, who are not well acquainted with Mr. Smith-Rewse; and his unfailing courtesy and charm of manner endeared him to all. Though deceased retired from active business at the end of last year, he remained on the Board of the Whessoe Foundry and Engineering Company, Ltd., and took the keenest interest in its work right up to the time of his death.

The death is announced of Mrs. JOHN G. TOOMS on Friday, Nov. 16, at Broadview, Tunbridge Wells. Her husband was at one time Manager of the gas-works at Waterford for some years; he then went for the Primitiva Gas Company to Buenos Ayres, and was afterwards appointed by the Corporation of Christiana (now Oslo) to design a new gas-works there, which, however, has not yet been erected. Mr. Tooms became Gas Engineer to the Corporation on the death of Mr. Oluf Pihl, and left a few years ago to commence practice as a Consulting Gas Engineer on his own account in Norway. He was present at the meeting of the Institution of Gas Engineers in 1925.

ON THE ELECTRICAL SIDE.

Power Scheme in Scotland.

Among the Bills which are being promoted in Parliament is one by the Grampian Electricity Supply Company, who are anxious to secure a huge extension of their area. The "Financial Times," in giving an outline of the scheme, states that the extended area will include the counties of Aberdeenshire, Banffshire, Kincardineshire, Nairn, and Morayshire, and parts of the counties of Inverness-shire and Ross and Cromarty, covering 6400 square miles. The existing area of 4214 square miles embraces the counties of Perthshire, Forfarshire, and Kinross, and parts of Inverness-shire, Argyllshire, and Stirlingshire. With the addition of the proposed new area, the Company will become the largest hydro-electric concern in the United Kingdom. Powers are also being sought to deal with certain hydro-electric works in the counties of Inverness-shire and Ross and Cromarty, in what is known as the Strath-Glass area. The whole of the issued capital of the Grampian Company is held by the Scottish Power Company. A contract has been entered into between the Grampian Company and the Central Electricity Board, to commence in 1930, by which the Board will be given a considerable supply of electric power. Five additional generating stations are to be erected in the new area. In the present area of the Company rapid progress is being made with hydro-electric power; works being erected at Kinloch Rannoch, while extensive transmission lines are being constructed with a view to supplying electricity to all outlying districts. The scheme is, our contemporary remarks, so extensive that it will take several years before it reaches fruition; but when it has been concluded there will be few of the isolated spots in the area without their supply of electricity.

Nottingham as a Basic Station.

With the recent opening by Sir Andrew Walker (Chairman of the Central Electricity Board) of a new turbo-alternator set at the North Wilford electricity generating station of the Nottingham Corporation, a further important stage was reached in the scheme for the development of East Midland supplies. The extension has also a material bearing upon the general plan which has been decided upon by the Commissioners for dealing with the Central England area, since Nottingham has been selected as a basic centre. Already £1,050,000 has been expended upon the undertaking, which is destined to become among the largest of the kind in the country. While indicating that the Board anticipated an era of important operations in connection with the station, Sir Andrew stated, at the luncheon which followed the opening ceremony, that he was unable at the moment, in face of so many rivals, to say what extended use would be made of the station. He added that it should be enough encouragement to Nottingham for the present to know that it had been scheduled by the Commissioners as a basic station.

A Necessary Warning.

Though no one, of course, would dream of condemning any useful appliance simply because it had caused an accident, it would be just as unreasonable to anticipate condonation of wrongful usage when it had led to a similar result. Electric heaters are designed for many uses; but in several ways they have their limitations, and these it is desirable should be kept in mind. Indeed, one might go farther, and say it is vitally necessary that at any rate one of the limitations should be emphasized, in order to avoid a menace to life. The limitation here referred to is not in respect of the heating capacity of the apparatus, but of the positions in which it should be used. An inquest last week revealed the fact that a young man had been killed by an electric current in the bathroom of his home at Eltham. The father said that after his son had gone into the bathroom he heard groans, and entered the room. He found his son leaning over the side of the bath apparently dead. An electric radiator was used to heat the room, and it usually stood on a shelf. After the accident he found it had been placed on the floor, and he thought his son must have slipped in the bath and fallen on to the heater or touched the wire when lifting it on to the floor. Mr. Penning (Deputy Engineer to the Woolwich Borough Council) said that one of the wires of the radiator was disconnected, and it was possible for anyone to receive a shock. He suggested that deceased had been touching the edge of the bath with his stomach while lifting the radiator to the floor, and that the bath being iron had caused him to receive the current as it was going to earth. The Borough Council had repeatedly warned consumers not to take such heaters into a bathroom. One must feel that this is a warning which should be widely issued, and in emphatic terms. At the inquest alluded to, the Coroner remarked that, in these days of electrical machinery, radiators, and wireless instruments connected with the main cable, the case gave one food for much thought.

The urgent need for such a warning was emphasized by Mr. A. A. Campbell Swinton, who addressed to "The Times" a letter in the following terms on the subject of "Electric Shocks in Bathrooms:" "Cannot something be done to draw public attention to the extreme danger of electric fittings in bathrooms? There have recently been reported two fatalities, in both of which death has been due to electric shock, caused by simultaneous contact with a bath connected to earth through its pipes, and an electric fitting connected to an electricity supply. These are by no means isolated cases of death being due to simultaneous contact with defective electric fittings and baths or pipes, or even earthed wireless sets; the reported fatalities due to these causes in this country amounting to quite a considerable number during the past couple of years. In bathrooms no electric fitting—not even a switch—should ever be within reach of a person in the bath or in contact with the latter, while no one using a wireless set should ever touch an electric fitting while wearing headphones or touching the metal parts of the set."

"Cheaper Electricity."

While a too simple method of charge for a commodity may have its disadvantages from the point of view of the developing of a business, a too complicated system may equally lay itself open to other objections, one of which is likely to be the loss by the purchaser of knowledge of his own whereabouts. A case of this kind would seem to have arisen in the neighbourhood of Glasgow—a place whose electrical affairs are at the present moment more or less in the public eye. We do not know whether the method of charging for current is as complicated as some others (it could not well be more so), but at any rate it has confused one consumer at Rutherglen, who has addressed a letter to a local paper under the heading of "Cheaper Electricity." His calculations it would require an electrician to unravel; but the burthen of his complaint is clear. He has been expecting cheaper electricity; but as a consumer in a three-apartment house (the average working man's dwelling) he finds that, instead of a reduction, he will have to face an increase of about 80 p.ct., "to meet the advantage gained by the larger houses." In his own case, for the last five years, his bills have amounted to above £2 per annum. Under the cheaper electricity scheme, he now finds his bill, by using the same quantity, increased to nearer £4, that is, by using on an average 200 units per annum. Disillusioned, he signs his letter "Going Back to Gas."

Danger of Dazzle.

Those who are unfortunate enough in these days to have to walk find yet another grievance against the motor-car in the dazzling headlights which are now employed both in season and out of season, though the blinding effect, of course, has far greater drawbacks than the inconvenience of the pedestrian. A writer in the "Observer," who regrets the passing away of the powerful yet diffused rays of acetylene gas, says that motorists, when using it, did not suffer a quarter of the discomfort they feel to-day from even the cheapest and nastiest electric lamp. "There were," he goes on, "not a tenth nor a hundredth of the same number of cars on the road in those days; but even so, when we were faced with a pair of big lights, we were not temporarily blinded, as we are now. It was no doubt the quality of the light itself, rather than the degree of its power or penetration, which made it so much better a driving light than electricity; but, whatever the reason, we are now left, for better or worse, with the latter as a universal illuminant—a fact which has given occupation for all sorts and conditions of interested persons, from Government Departments upwards, ever since the war, with, it has to be conceded, extremely meagre results." The point raised here is quite an interesting one—we do not refer to the remarks upon the general boosting of electricity by Government Departments and others, though these, as coming from an independent source, are worthy of note. What strikes one chiefly is the argument that dazzle is due to the quality of the light emitted from the electric bulb, rather than the volume of illumination.

Where Neither Flues Nor Chimneys are Needed.

A writer in an electrical contemporary says the architect knows that there is only one way of avoiding flues and chimneys altogether. We have known for a long time of one way; but this is imagined not to be the way known to the architect who, one would suppose from what is stated, takes the view of the writer referred to, in regarding flues and chimneys "as a very troublesome and costly feature of a past stage in civilization." To an asthmatical man breathing is a "very troublesome" process; but he does not suggest that it can be done without. No; Nature persists in her old-fashioned methods. She insists on man breathing, and ventilation is necessary if breathing is to be carried on. Architects know this, and fortunately few seem anxious to immure their clients in rooms devoid of all ventilation. As for the "one way of avoiding flues and chimneys altogether," we would suggest that the path to the family vault, though well known, is not popular. This is the only structure which occurs to us the occupants of which require neither flues nor chimneys.

The World Fuel Conference and the Gas Industry.

A Retrospect.

By E. W. SMITH, D.Sc., F.I.C., and T. CAMPBELL FINLAYSON, M.Sc.

A Series of Four Articles: IV.

In the previous article, the writers discussed the problem of the production of solid smokeless fuel for domestic purposes by either high-temperature or low-temperature carbonization methods. Whichever process proves in the long run to be the more efficient method of production, one thing is certain—domestic smokeless fuel must be made from clean coal.

The Need for Clean Coal.

As the Director of Fuel Research says, "Coking, whether high or low temperature, cannot be regarded as a means of producing a satisfactory smokeless domestic fuel from coals which owe their low price to a high ash content." In many cases high-class coke depends upon blending and disintegrating the coal prior to carbonization. Such fuel, when burned in an open grate, leaves the ash in the form of a fine powder which, if in any quantity, deadens the fire, and in any case creates a nuisance. The gas industry may therefore be said to have a vital interest in the development of coal cleaning processes.

Dry and Wet Methods.

A session of the conference was devoted to the discussion of coal cleaning by wet and dry methods. Of the coal cleaned in Europe at the present day, 90 p.ct. is cleaned in jigs of one type or another, or in Rheolaveur washers; but other processes—notably the various dry cleaning systems—are coming into general use. Though dry cleaning is not generally as efficient as wet cleaning, yet the former has an attraction in many cases which will lead to its wide adoption. The coal industry is thus rapidly approaching the time when it will be in the position to supply cleaned coal, if there is a sufficient demand for this material.

The Cost of Clean Coal.

Probably the most difficult problem in connection with coal cleaning is the determination of what constitutes clean coal. The loss in the form of refuse and coal associated with the refuse may assume very large proportions. W. R. Chapman discusses this in a paper (C.4). He shows that the ash content of a coal may be reduced from 8 p.ct. to 6 p.ct. by rejecting 2·6 p.ct. of material; but to reduce the ash content from 4 p.ct. to 2 p.ct., the minimum amount of material that can be rejected is 12·5 p.ct. of the total. This is a factor that must be borne in mind by consumers who demand very clean coal. In his paper "A Fuel Policy" (W.2), Sir Arthur Duckham shows that, if a dirty coal containing 20 p.ct. of ash and costing 10s. per ton be cleaned by dry or wet methods, so that it contains 5 p.ct. of ash, then, in order to cover the cost of cleaning, together with the loss of material in the form of ash and tailings, a ton of clean coal cannot be obtained for less than 13s. 6d.

The Advantages of Clean Coal.

The price of a ton of clean coal may be greater, but the gas undertakings will derive, directly and indirectly, many benefits by the use of such material. Consider the case of a gas undertaking which normally buys 100,000 tons of a particular coal containing 10 p.ct. of ash. If the undertaking decides to buy the same coal in a cleaned condition, containing 5 p.ct. of ash, the following savings might be expected.

1. The saving of the transport of about 5000 tons of material.
2. Less weight of material to be stored, handled, and treated per therm of gas made.
3. Better quality coke containing 7 p.ct. of ash instead of 14 p.ct. of ash.
4. Better working of the producers, and less ash to cart away.
5. Enhanced value of the coke made.

Developments in Methods of Gas Production and Bye-Product Recovery.

The standard British processes and plants for the production of coal gas and water gas did not receive detailed consideration in any of the papers presented at the conference. This omission is, however, not a sign that there has been an absence of progress in methods of gas production. Prof. J. W. Cobb, in his paper on "Gas Manufacture" (H.8), shows that the thermal efficiency of the carbonization process, allowing for the heat used and lost in manufacture, has increased from 70 p.ct. in 1919 to 85 p.ct. at the present day for a modern carbonizing plant with waste-heat boilers. A modern carburetted water gas plant, with waste-heat boilers, works with an over-all efficiency of about 70 p.ct.

Bulk Carbonization.

From a consideration of the papers, one tendency can be noted—namely, the growing acceptance of the principle of bulk carbonization in different parts of the world. It may be of interest to review the information concerning bulk carbonization, and then to discuss the possibilities and limitations of such processes for the British gas industry.

Coke Ovens for Town Gas in America.

In America there has been a rapid advance in the use of coke ovens for the manufacture of town gas. In the paper by the U.S. Bureau of Mines on "Domestic Fuels other than Anthracite" (H.6), it is stated that in America the coke oven has become the most economical service for base-load city supply. In 1921, coke ovens furnished only 11 p.ct. of the coal gas for city use; in 1926 their share had increased to 20 p.ct. Since Jan. 1, 1926, nine installations of bye-product ovens for city gas manufacture have been built, and five more are now under construction. Discussing the coke oven as a gas-making plant, the Bureau of Mines say: "Without a balanced demand for both coke and gas within the radius of economic transmission, the coke oven can hardly compete. Its adaptability to mass production, and the degree of flexibility introduced by heating the ovens with producer gas, have made it an efficient means of producing city gas; but it will be installed only where the net cost of gas, all credits considered, is less than the cost by alternative methods of manufacture. The final choice can be determined only after consideration of local conditions."

How the Coke is Used.

In considering the American position, it must be remembered that the widest application of coke in that country is as a substitute for anthracite for closed stoves. Therefore a dense fuel, without any special properties as regards ignition temperature, is required. Particular attention is, however, paid to the screening of the oven coke for the domestic market. All plants which make a speciality of domestic coke are equipped to crush and size the product. All breeze is removed. The sizes most commonly made are egg and nut, though stove and pea are also prepared. The approximate sizes are as follows:

Egg	3 in.	to 2½ in.
Stove	2½ "	" 1¼ "
Nut	1¼ "	" ¾ "
Pea	¾ "	" ½ "

In general, egg, stove, and nut bring in about the same price, while pea sells at a lower price.

Quick Coking Times.

Discussing recent developments in bulk carbonization in America, W. H. Blauvelt, in his paper (H.10), states that the largest ovens now operating in America have a capacity of 20 tons per charge. The number of ovens in one battery has been increased to contain as many as sixty. The coking time has been greatly reduced; one inch per hour is regarded as a very moderate speed, and

one plant has a record of two months' operation at more than 1·3 in. per hour.

F. Menzel, describing the methods of gas production at Vienna (Paper H.5), states that at two of the works of the Vienna Municipal Gas-Works coke ovens have been installed, being heated by automatic slag-removing rotary-grate producers. Using small lump coke, even with high ash content, the producers make a gas free from dust, and ensure the uniform heating of the ovens. In order to improve coke quality, each of the works disintegrates and blends the coal. It is stated that "the coke is of very good quality, and is therefore displacing foreign metallurgical coke."

Conditions Necessary for Coke Ovens.

Examining these developments from the viewpoint of the British gas industry, the first noticeable feature is that the coke from coke ovens is being sold as a substitute for anthracite for use in closed stoves, or for metallurgical purposes. The possible application of coke ovens to British gas-works practice may perhaps be briefly summarized as follows. The modern coke oven is a highly efficient form of high-temperature carbonization plant, provided it is operated under suitable conditions. These conditions are:

1.—It must be kept in continuous operation, though the output of a battery of ovens can be varied considerably by altering the carbonizing time, with a corresponding variation in cost of operation.

2.—The economics of operation of a coke oven plant depend to a large extent on the daily carbonizing capacity of the battery. A battery comprising a small number of ovens has to bear an excessive capital charge in the pushing and charging machinery.

3.—Coke ovens give a dense coke which cannot be substituted indiscriminately for some other types of coke. The market for coke oven coke must therefore be reasonably assured.

A Proposition Limited to Large Undertakings.

Therefore, except in the case of large undertakings which can ensure the continuous operation of a reasonably sized battery of ovens at full load, coke ovens do not come within the usual consideration of carbonizing plant for the average British gas-works. Where, however, conditions are such that a gas undertaking can maintain (say) a 1000-ton per day battery continuously in full operation, and only regard this as a portion of their total carbonizing plant, a coke oven installation has many attractions. In these circumstances maintenance costs are low—certain of the American installations of silica ovens have worked over ten years continuously—labour costs are very low, and net fuel costs are comparable with other systems.

The Cost per Therm.

Upon one feature it is, at the present day, difficult to obtain satisfactory information. From a study they have made, the present writers believe that, if a consideration be made of the production of (say) 510 or lower B.Th.U. gas, first in coke ovens, bringing down the calorific value of the gas with water gas or by benzole washing; secondly, in intermittent vertical chambers; and thirdly, in continuous vertical retorts—then, under the same conditions, the cost per therm of gas made will be slightly higher in the coke oven system than in either of the other two methods. But this difference is so small in comparison with the average *selling* price of gas that, if there is any justification, from other considerations, for the installation of coke ovens, the cost per therm may be taken as the same.

Bye-Product Ammonia Recovery.

The gas industry is at the present time faced with a serious problem in connection with the disposal of ammonia. It was therefore to be expected that the valuable contribution by Mr. Parrish, on "Some Technical and Economic Aspects of the Bye-Product Ammonia Problem," should arouse considerable interest. In the first of these articles the present writers drew attention to Mr. Parrish's suggestion that a rational solution of the bye-product ammonia problem lay in arranging that the recovery of ammonia at the majority of works should only proceed to the point of making either a concentrated gas liquor or a concentrated solution of ammonium sulphate, leaving the actual conversion into ammonium sulphate crystals of uniform quality to be undertaken at central works.

Direct Recovery Pros and Cons.

This paper prompted a plea from Mr. L. H. Sensicle for a consideration of the direct recovery process. In Mr. Parrish's view there is no such thing as a direct process of sulphate of ammonia production on gas-works. If condensation prior to the absorption of ammonia in sulphuric acid is avoided, ammonium chloride is usually carried to the saturator, causing corrosion. If corrosion be overcome by spraying, then a thick viscous tar, containing ammonium chloride, is produced. Further, the devil liquor condensed after the saturator is not inappreciable in volume, and is toxic. For the above reasons, and also from the fact that the tar is not so satisfactory, Mr. Parrish considers that "the so-called direct process is unsuitable for application to gas-works." He points out that the "semi-direct" process obviates a number of the disadvantages associated with the direct process.

In answer to these criticisms, Mr. Sensicle states that in practice there is no corrosion by reason of the dissociation of ammonium chloride, because the chloride is removed by the liquor spray in the tar extractor. He considers that direct recovery tar is an improvement, because it is divided into two fractions—a heavy tar which comes down first and is particularly suitable for road purposes, and a light fraction containing the light oils and creosote which is condensed on cooling the gas. The devil liquor can be rendered innocuous by benzole washing. The present writers consider that at the present day, when so much more attention is being paid to the specifications of both sulphate of ammonia and tar, Mr. Parrish is right in stating that the direct process is not suitable for gas-works practice. While it may be a technical success, it is not so easily controlled, nor so flexible, as the indirect system. In addition, it does not produce such high-grade tar and ammonia products. They believe, however, that the main disadvantages associated with the direct process are removed by the adoption of the semi-direct process.

The Anhydrite Process.

In his paper, Mr. Parrish also gave some interesting information relating to the anhydrite (calcium sulphate) process for sulphate of ammonia production. He discusses the technical and economic aspects of the anhydrite process in comparison with the standard sulphuric acid processes, and shows that for the treatment of bye-product ammonia the anhydrite process requires a far more complicated plant than does the standard sulphuric acid saturator plant. The plant involves crushing, grinding, and screening machines, reaction vessels, carbon dioxide purification plant, special filter presses, evaporation plant, and rotary driers. Mr. Parrish shows that the economics largely depend upon the price at which anhydrite can be purchased at works, and considers that the anhydrite process has an advantage in price varying from 20s. 8d. per ton of sulphate of ammonia where anhydrite can be obtained favourably, to 8s. 8d., where the ammonia works are situated less favourably, as, for example, in London. His conclusion is: "It is obvious, therefore, that the anhydrite process as an alternative to the use of sulphuric acid needs to be carefully considered. The nature of the process, however, necessitates a medium-sized scale of operations, and it is the writer's view that plant to deal with *less* than 30 to 40 tons of ammonium sulphate per day would not be warranted." The industry owes a debt of gratitude to Mr. Parrish for a very lucid paper.

Condensation Methods.

The problem of the disposal of sulphate of ammonia plant effluents has brought the subject of condensation methods into prominence in recent years. It is generally accepted that improved methods of condensation will greatly reduce the obnoxious constituents in effluent liquor. Prof. Cobb expresses this view, in his paper (H.8), in the following words: "Proper thought and design, even in existing plants, will lessen the quantity of effluent; while bringing down the tar as quickly as possible, separating it as soon as possible from the liquor, and minimizing the

contact with oxygen, particularly while the tar and liquor are hot, will lessen the production of harmful ingredients." Design of condensation apparatus has a marked effect upon the nature of the ammoniacal liquor. Water-tube condensers give the least harmful ammoniacal liquor; atmospheric condensers the next best; and washer-coolers the worst. The cause of the toxic constituents in liquor from washer-coolers is the repeated pumping and circulation of the liquor through the tower.

Hot Liquor Circulation.

An interesting development, which is stated to have greatly improved the recovery of bye-products in connection with coke oven practice, is mentioned by W. H. Blauvelt (H.10). In place of the circulation of tar through the gas collecting mains, the present practice is to employ sprays of liquor collected from the gas itself. These sprays not only wash the surfaces, but also immediately bring down the temperature of the gases to 80° C., thus preventing the formation and accumulation of pitch. When properly applied, this flow removes all manual labour for cleaning the collecting main. The amount of circulation for best results for coke ovens averages about 45 gallons per hour per ton of coal coked per day. This scheme for the circulation of hot liquor in place of tar has already been adopted by a number of gas undertakings. It is a sound proposition, and should in addition help to increase the strength of ammoniacal liquor made, and to reduce the troubles associated with effluent disposal.

The Drying of Coal Gas.

The drying of coal gas prior to distribution has been much discussed in recent years, and it is therefore of interest to note what was said on the subject at the conference. Mr. Charles Cooper, in his paper on "The Purification of Coal Gas," states that, for moisture to have any deleterious effect in distributed gas, two conditions must be satisfied. The water must be condensed in the liquid state, and there must be some oxygen present. From a practical point of view, the drying of gas signifies that it should be so far dehydrated that it will be free from the possibility of further condensation through its journey to the point of consumption. A removal of from 50 to 60 p.ct. is usually sufficient. The four main methods of dehydration are compression, refrigeration, and chemical and physical absorption and adsorption. In Mr. Cooper's view the most economical process is the drying of gas by means of a solution of calcium chloride. "The results, as regards maintaining a water-free distributing system, have been realized throughout, and the cost, which is under 0·25d. per 1000 c.ft., has been more than repaid by the cessation of complaints and the progressive reduction in the rate of degradation of dry meters."

Coke Quenching and Screening.

It was to be expected that the conference would consider the important subject of coke quenching and screening; and in the papers by Mr. W. Colquhoun on "Coke Quenching and Cooling" (G.7), and by Mr. W. S. Edwards on "Coke Screening," is to be found an account of the progress which has been made in these two branches respectively.

Remote Quenching.

Dealing with coke quenching, Mr. Colquhoun states that, where water quenching is practised, the method of "remote" quenching is the most efficient. This process consists in conveying the coke in a quenching car to a quenching station which consists of a tower in which is grouped a series of spray pipes. It can produce a quenched coke with a constant water content of about 2 p.ct. The amount of water used is normally about 600 gallons per ton of coke. This method is generally adopted in American high-speed coking plants, and is coming into use in Great Britain. Mr. Colquhoun makes the statement: "The continuous vertical retort solves the problem of quenching in a most attractive manner. The heat of the coke is recovered, and the coke itself is delivered dry. Without doubt that system of carbonization has been the principal agent in promoting the improved standard of gas-works coke now so constantly aimed at.

Dry Cooling.

Schemes for the dry cooling of coke are also attracting considerable interest and are meeting with success. Mr. Colquhoun shows that, though the first cost of the plant is high, under average conditions the credit from steam raised will easily provide for the redemption of the plant in seven to ten years. It is stated that the installation at the gas-works of Utrecht, which was started at the end of 1926, cools 350 tons of coke per 24 hours. The plant supplies the gas-works with its requirements of saturated steam, and also with steam at 200 lbs. per sq. in. and 650° Fahr. to drive a 750 kw. turbo-generator.

Coke Screening.

In his paper on "Coke Screening" (G.12), Mr. W. S. Edwards gives a valuable review of the principles which govern the design of suitable coke screens. In describing the nature of coke, he writes: "It is unfortunate that coke has to be handled, screened, and stored, for the reason that its physical character resembles that of an imaginary material having some of the leading characteristics of an *egg*, an *emery wheel*, and a *sponge*. The greatest care therefore is required to reduce breakage to a minimum; and the design of all machinery for coke handling must have special regard to the rapid wear which will take place in the parts with which the coke comes into contact. Again, coke, being full of pores and cavities, allows of large pieces becoming filled with smalls and fines which do not separate out until after the large coke has found its way to the storage heap or truck, unless this fact is fully recognized in the choice of apparatus used." The gas industry might well remember this "egg, emery wheel, and sponge" allegory in considering the design of its screening plants.

THE CONTRIBUTION OF THE GAS INDUSTRY TO SMOKE ABATEMENT.

In his paper on the "Gas Industry as a Source of Domestic and Industrial Energy," Mr. F. W. Goodenough emphasizes the very great part which the gas industry is playing in the abolition of atmospheric pollution. The disadvantages to health, the deterioration of buildings, the psychological as well as medical effects of the lack of sun caused by smoke, are all too well known to need further stress. It is not, however, so well known that approximately five-sixths of the total smoke comes from the domestic fire. As Mr. Goodenough pointed out, the gas industry has already achieved great things by causing the substitution of 17 million of tons of domestic coal and 2½ million tons of industrial coal by smokeless fuel in the form of gas. If the gas industry follows up the possibilities of the use of gas in industry, and at the same time makes every effort to provide a solid smokeless fuel in place of coal for the open grate, it will be increasingly the dominating force in the prevention of atmospheric pollution. The phrase "prevention of atmospheric pollution" has been used in place of "smoke abatement" because the two phrases are not synonymous. The generation of electricity is not by any means smokeless, and in addition it causes pollution of the atmosphere through the sulphur compounds which are evolved during combustion of the fuel. In the process of gas manufacture between one-half and one-third of the sulphur in the coal is isolated, and thus is prevented from passing into the atmosphere.

Conclusion.

In conclusion, may it not be said that the message of the World Fuel Conference to the gas industry was one of encouragement and promise? It has been an inspiration to read of the growth of industrial gas in America; the developments in the distribution of gas in Germany; the methods of gas production in Austria and Japan. It may even be true that we have much to learn from the developments in other lands. But throughout there has been the feeling of satisfaction that the delegates from the Dominions and other countries have been visiting the land of William Murdoch. May not the deliberations in London last month encourage the British gas industry to make a great progressive step forward by recognizing the four outstanding lessons of the World Fuel Conference: Rationalization; the replacement of domestic coal by a solid smokeless fuel; the development in industrial gas sales; and co-operation with the coking industry.

COKE OVEN MANAGERS' ASSOCIATION (MIDLAND SECTION).

Presidential Address of W. H. RUSSELL (Chairman), delivered at the Annual Meeting held in Sheffield on Nov. 14.

So much has been said by recent speakers at technical and other meetings, and written in various units of the Press by all and sundry, that there is a dearth of new ideas concerning what should be done in, and with, the coke oven industry. The more one reads of the various ideas, the more complicated the subject of metallurgical coke manufacture (economically) becomes.

Even the technicians of the industry are criticized, and compared with their fellow technicians of the gas industry. Such ideas certainly do not emanate from the Coke Oven Managers' Association, whose members are fully capable of appreciating the other man and his abilities, in whatever direction they may lie, though we may possess a member who fancies he could give points on any subject to all and sundry.

It would be extraordinary if an industry founded over a century ago, sheltered in every way, possessing an absolute monopoly in definite areas, and facilities for altering the price of their principal products, for research, and for trying out any new idea that came along, did not provide such attractions to the intelligentsia of the world, by way of lucrative and secure posts, as to enable it to have at its head splendidly able men.

The gas industry has been able peacefully-to proceed with its development during the past 100 years with, one might almost say, perfectly free hands, for it is purely local or internal, and its size in the main depends entirely upon the purchasing power of the general public. This power has only reached its present state through the influx of wealth from the Colonies and from foreign countries, and which in part came from our industries whereby we were enabled to export goods to a value in excess of our imports.

As opposed to this, the bye-product coke oven industry, as it exists to-day, was comparatively recently thrust, by foreigners, upon a number of unbelieving colliery owners, who either said they had not the money (or would not risk what they had) or were so conservative that they would not try out a new idea unless someone else paid for it. The result of this was that the cream of the then available profit went to other lands, instead of being utilized in the rapid development of the industry in this country. That state of affairs existed, with exceptions, up to 1914; and while billions can be found to start new industries, very little can apparently be found to re-organize our industry, which is of paramount importance to the maintenance of what once were our staple industries, iron and steel.

USE OF COKE OVEN GAS.

Despite the proposed governmental and other inquiries into the possible expansion of the use of coke oven gas, there is no real evidence that the owners of to-day are one whit different from the owners of 25 or 30 years ago; for though one hears of combines, groupings, absorptions, and a rumour of a proposed large coke oven plant to be owned by several colliery proprietors, one has, if one believes the first rumour, also to believe the second rumour, which indicates that they have fallen out about who is to manage it or how it is to be run.

Regretful as it is, I feel compelled to believe the second rumour; for there is, to me, an extraordinary amount of evidence in all directions to indicate that those people in whose hands lie the destiny of the coke oven industry do not view it nationally. It is treated in such a way as to suggest that the putting-up of three or four, or a few more, low-output ovens as an adjunct to an already defunct battery, or the erection of a complete new battery of a few—twenty or so—ovens should be looked upon as a personal triumph for someone, whereas it is a suicidal policy and a waste of the national wealth.

One of the pleas of the colliery owners would be the same as one often hears from other folk—that if there were central plants they would have to pay heavy tariffs on the coal transferred from the collieries to the ovens. Personally, I am certain that the railway governors already have enough sense to see—and failing this could very soon be educated to see—the advantages of a reduced tariff on the enormous volume of centralized traffic which would accrue to them from the adoption of the central coke oven plant as opposed to the present system where they transport only a very small proportion of the coking slack used in the industry.

COKE OVENS AT THE IRONWORKS.

Then there are those advocates who state that the ovens should be situated at the ironworks, and that the latter should be situated at the steelworks. I believe they are right; but the necessary capital will have to be found to build such a plant or plants, and there would be the same outcry concerning the impossibility of raising the money to do it. The iron and steel industries are suffering from the same complaint in that only portions of their plant have been brought up to date.

Because, to obtain coal, it is necessary to sink a shaft at a coalfield, it does not follow that a coke oven plant must be at the pit-head, to overcome the objection and cost of railway transport. Would it not be possible, in an area such as that of South Yorkshire, where the pits are so close to each other, to transport underground all the coking slack to a central plant, even though it entailed the construction of a central shaft for the withdrawal of the slack at that plant?

I think it may be said with truth that the cost of new railway wagons to keep a 1000-ton per day coke oven battery fully supplied with coal in such a way as to secure continuity of supply against holidays, week-ends, fogs, &c., would be well in excess of £100,000; and I feel certain that even that sum, and more so a multiple thereof, would go a long way towards an underground scheme. In any event, is the industry to be kept in its same crude state because of the monopoly possessed by the railways? I cannot believe that the railways desire it. There are methods of transporting coal other than by rail; and I have never heard of one of these being seriously considered for long distances. I refer to the pumping of coal either by air or water. Could either be economically employed for long distances, or are the technical difficulties too great?

A great deal has been said of late in the Press, and at meetings of all descriptions, concerning the utilization of surplus coke oven gas; and I would like to reiterate, in such a manner that there will be no possibility of my being again misquoted, what I said in reply to Dr. E. W. Smith when he so kindly read his very interesting paper here, on Jan. 26, 1927. This country should be divided into about six areas for the purpose of the erection of central coking plants, in order that the surplus gas could be economically distributed to the surrounding areas. I should certainly not connect up to any area which could not be economically supplied.

RESEARCH.

The coke oven industry is being held up to ridicule because it does not appear to spend anything in research; and the Coke Oven Managers' Association is held responsible for this apparent lack of enterprise. Again I must refer to my previous remarks upon the spirit in which the industry—or conglomeration of units—is run. I firmly believe that the argument would be advanced that, were it not for the fact that many colliery companies possess coke ovens, they would have to close-down their pits—not because, as some imagine, the coke ovens are making fabulous profits, or are even making any profit, but because they enable the collieries to get rid of the slack at such a price as permits them to continue running at a smaller loss. One must give credit to many colliery proprietors for their self-sacrifice in order that their employees should not be thrown out of work. Think of the hurt to personal pride if central coking plants were in vogue, and it was left to a managing committee to decide from which pits the coal would be drawn, and which pits were to be closed down!

Coke oven managers, in the main, look upon central coking plants with the same suspicion, and for almost identical reasons. Why allow the fear of personal loss, or hope of personal gain, to influence us when considering what is best for our country? Rest assured that what is best for our country is also best for us.

During a subsequent discussion, Mr. P. B. NICHOLSON (Hon. Treasurer) referred to the National Fuel and Power Committee and the Advisory Committee to be appointed to consider recommendations made in connection with the coke oven industry. They had to face hostile interests in the gas industry in connection with the supply of coke oven gas, he said; and he wanted to suggest that there should be appointed to the Committee someone who was sympathetic towards coke oven gas. He would like to suggest that in South Yorkshire an ideal individual to be appointed would be Mr. Ralph Halkett, of the Sheffield Gas Company, who had taken a vital interest in the matter.

"Transactions of the World Power Fuel Conference."—Messrs. Percy Lund, Humphries, & Co., Ltd., announce that early in the new year they will publish the "Transactions of the Fuel Conference" held at the Imperial Institute, South Kensington, from Sept. 24 to Oct. 6. The volumes will include all the papers presented at the Conference, and full reports of the discussions to which they gave rise. The price of the volumes is £12 net, but there is a special pre-publication price of £10 net.

INSTITUTE OF FUEL.

PRESIDENTIAL ADDRESS

Delivering the Presidential Address at the Autumn Meeting of the Institute of Fuel on Wednesday, Nov. 21, the President, Lord Melchett, said that this was the last time he would address them as their President, for Sir David Milne-Watson had consented to accept the Presidency. But as their Founder President he (Lord Melchett) would do all he could to further the interests of the Institute.

The fuel and coal industries of the country were unbalanced, and, though good in some parts, were in a bad condition in others. Looking back over the history of Britain it was evident that coal was a comparative newcomer in the national life. The industrial revolution, and the general use of iron as a substitute for wood, gave a great impetus to the coal trade. Britain took the lead because, besides inventive genius, she had energy and practical application. She had the great natural advantage of coalfields near the sea, and iron at reasonable proximity to the coal. This lowered export costs of manufactured products, and developed the export coal trade. The first phase of the industrial revolution had spent its force; the second was well on its way towards practical results. Contrast modern tendencies in progressive industry with the spectacle of three thousand independent collieries, each working its own pits in its own way. They, in the Institute of Fuel, were continually endeavouring to make substantial economies in the use of fuel. Britain used in manufacturing, in collieries themselves, in domestic consumption, and in railways a very large proportion of her home consumption. They all knew that the amount used in these categories could be greatly decreased, and they were steadily attacking the problem. Steam generating plants, for example, were constantly increasing their pressures; and a new boiler plant under erection in one of the factories of Imperial Chemical Industries would shortly generate steam at a higher pressure than any other in the country, and produce electricity cheaper than anywhere in the world.

The coal trade was faced with the problem of tiding over the present period of disorganization and over-production in such a way that the world's output of coal, when used with the greatest economy, would satisfy its needs. The formation of the Fuel and Power Committee, of which he was Chairman, showed that the country was taking the fuel question seriously. He wished particularly to draw their attention to the suggestion contained in the Fuel and Power Committee's report that the coke oven industry should centralize its research. The unemployment in the coal industry was a serious factor in the total unemployment of Britain. Nearly 300,000 miners were unemployed, of whom between 200,000 and 250,000 were a permanent unemployable surplus in the industry. It was a desperate load for an industry to assume; and the general desolation caused was almost too dreadful to think about. Efficiency was necessary not only in technical achievement, but in organization. The coal situation was a world problem. During the coal strike he had done his utmost to emphasize the importance of a rational organization, particularly on the selling side. A certain amount had been done in the meantime; 80 p.ct. of the anthracite industry was merged; and the Five Counties Scheme was a great step forward, because it brought production into relation with demand. It was the height of folly to sell anything at an unremunerative price. A coal selling scheme for South Wales was under discussion, and meetings contemplating a national scheme were being held.

Particular movements, both technical and otherwise, called for comment. Powdered fuel plants were on the increase. A great public utility company had taken up the "Coalite" low-temperature carbonization process. Coal should be sold in a better classification; there should be a standardization in screening. He would like to draw their attention to Dr. Lessing's coal cleaning method, which was being operated by one of the companies in which he was interested. The process depended upon the relative densities, in a suitable medium, of the wanted and unwanted portions of coal. Contrary to expectation, no difficulties in removal of the flotation medium had been experienced. Coke made from coal thus cleaned was low in ash, and reduced production costs in pig iron. The Institute of Fuel had created a Fellowship that was a real mark of technical distinction. The regulation had been drawn up to include both academic and technical ability. The Institute owed a debt to Prof. M. W. Travers, F.R.S., the Chairman of the Committee, who had drawn up the Fellowship regulations.

The German problem in some respects resembled their own. Germany lost part of her coalfields in Silesia and Lorraine. Her export markets contracted, while at the same time her home supplies diminished. In Germany, however, the position was different from that in Britain. Germany had already had to bear the brunt of a most formidable British competition for over a generation. Her coal industry had accordingly organized itself through various coal selling and price controlling associations. Prices had been regulated, and a fair price obtained at home for the coal; and un-coordinated competition in the export markets had been avoided. It was hardly going too far to say that, had the commercial organization of the German coal industry not been in a satisfactory condition before the war, it could never have weathered its post-war difficulties.

Lord Melchett urged that the coal problems of the world were one. A particular country might have a particular disadvantage, but if they examined the question closely they would find that frequently there were compensating advantages. The main factor in the re-establishment of the coal industry of this country on a sound economic basis was its internal reorganization in technology, commercial directions, and labour relations, followed by imperial and international reorganization and agreement. Countries like their own, which depended upon export to a considerable extent, would have to make an arrangement with other coal-producing countries. Internal reorganization should take place promptly. In what other industry would unproductive units be tolerated such as were seen in the coal trade the world over?

The general fuel problem facing this country was an extremely complicated one. They were frequently faced with the rival claims of gas and electricity. There should be no such rivalry. There was another side of the coal problem which had not received sufficient attention. Some years ago coal had been called carbon. Coal was anything but that. The first of the problems depending on the fact that coal was not carbon, but a complicated hydrocarbon, was already being tackled with energy. He was referring to the conversion of coal into oil, which would undoubtedly yield an economic solution in the next decade. Further, the problem of the direct employment of coal for what it was—namely, a complicated chemical substance—was as yet in its infancy.

ANNUAL DINNER.

There was a very large attendance at the annual dinner of the Institute, which took place on Wednesday evening at the Connaught Rooms, Great Queen Street, W.C. The speeches, which were by well-known men, were interesting and to the point; and this portion of the proceedings was not unduly prolonged. The presence of many ladies added brightness and charm to an enjoyable function; and the fact that they had been promised time for dancing afterwards may have contributed towards keeping the participants in the toast list "in the straight path." The Right Hon. Lord MELCHETT, P.C., LL.D. (the President), who was in the chair, proposed the toast of "The King;" and it was then announced that the following cable had been sent to Mr. T. S. Baker, of the Carnegie Institute of Technology, Pittsburgh: "Lord Melchett and members of the Institute of Fuel, assembled at annual dinner in London, send greetings to the members of the Bituminous Coal Conference in Pittsburgh."

RESEARCH THE FATHER OF INVENTION.

The Right Hon. W. C. BRIDGEMAN, P.C., J.P., M.P. (First Lord of the Admiralty), submitting the "Institute of Fuel," said the Admiralty followed the work of the Institute with the greatest interest, and would do everything possible to further the researches. If necessity was the mother of invention, research was the father of it. If they were able to draw from these islands all the fuel required for the Navy—at a reasonable price—they would be delighted to do so. He had given instructions to his advisers at the Admiralty to do everything they could to carry out any suggestions made by the Department of Scientific and Industrial Research; and he could assure them that the Admiralty, provided it could obtain a little more money—which was very hard to do—could do something to help in the experiments that were necessary to prove the value of the various kinds of fuel that were continually being devised. So far as smokeless fuel was concerned, he had tried it in his own house some years ago, and would like to see it experimented with in the Admiralty office—if he could get some, which was not so easy to do as some of them might imagine. [Laughter.] He wished the Institute every success, and paid a great tribute to the work being done by Lord Melchett in placing his great scientific and industrial knowledge at the disposal of the nation. It was very gratifying to know that he was to be succeeded as President by a man whose great knowledge was fully recognized by all who knew him—he referred to Sir David Milne-Watson.

A QUESTION OF COST.

The PRESIDENT, in his reply, said that, in view of the anxious moments to which the provision of fuel gave rise during the great war, it was not astonishing to hear the First Lord refer to the possibility of producing from our own coals all the fuel required for our own Navy. It would take too long to go into the different processes and experiments which were being carried out on the production of various kinds of fuel oil; but he would say that, if it was desired to produce oil in large quantities, the only method of which he was aware was that of direct hydrogenation of coal, the technique of which was well established. So far as his own firm was concerned, he could say at once

that they could produce liquid fuels in any form from British coals by pressure processes—at a cost. It was all a question of cost; and when the time came it would be for the authorities to make up their minds as to what it would be really worth while to do in the way of erecting plants in this country to provide the necessary means of making oil for the Navy. He was glad to think his successor in the chair was to be his friend and colleague, Sir David Milne-Watson, who possessed a lifelong knowledge of subjects affecting the utilization of coal, and, what was still more important, who brought to his task a charming personality, a knowledge of men, and a spirit of enthusiasm which endeared him to all who enjoyed the privilege of co-operating with him.

The Gas Industry in Urgent Need of New Legislative Garments.

Sir David Milne-Watson, LL.D., D.L., submitting the toast of "The Visitors," thanked Lord Melchett for the kind things he had said about him, and said he greatly appreciated the honour that had been done him in electing him President of the Institute. Some people might feel that there were already far too many conferences, associations, institutions, and meetings; but his own view was that in these days of rapid scientific and industrial development and change, and of constantly increasing competition, it was essential to make the very best use of all the knowledge available. Interchange of experience and information was necessary not only in the interests of individuals, but in those of the country and of mankind in general. The extremely successful recent meeting of the Fuel Section of the World Power Conference was an admirable example of the desirability of centralizing the work of dealing with the different sections of the world's fuel problem. The Institute of Fuel was operating in a more limited sphere; but it was doing work of great importance. It was primarily concerned with the subject of coal, and was complementary to the larger conference just held in London, of which it formed a necessary part. The Fuel Institute had had a short existence, but a very useful one; and its usefulness was growing day by day. They were particularly honoured to have present His Excellency the Japanese Chargé d'Affaires, because not only was Japan in fuel, as well as in other matters, well abreast of modern developments, but the next meeting of the Fuel Section of the World Power Conference was to take place at Tokio. He conveyed to His Excellency their best wishes for the success of that conference.

These were days of rationalization, and the Institute was supporting economy and efficiency in all directions. Now, in the course of his Presidential Address last year, Lord Melchett, in a moment of unwonted pessimism, said it was a melancholy fact that after all these years of dealing with fuel problems in this country, they were still in a relatively backward and crude position. No doubt Lord Melchett had in his mind, as one of the things, the legislative difficulties under which the gas industry laboured; and for that reason he (the speaker) felt a special satisfaction at the presence of the First Lord of the Admiralty, because he wished him to do all he could to restore Lord Melchett's optimism in this respect. In truth, the gas industry was in urgent need of new legislative garments. Its trousers were supplied by Parliament as long ago as 1847, in the form of the Gas-Works Clauses Act. They were very good trousers; but in accordance with the fashion of the time, they were very tight and narrow. There was no room for the expansion of the wearer in any direction; yet the wearer was growing rapidly. These regulations put upon them in 1847 in course of time became so antiquated that in 1871 Parliament provided them with an overcoat in the form of a new Act, to cover up the deficiencies. This overcoat, though a good one when it was made, had, in its turn, become completely worn out. In 1920, seeing the industry's distressed condition, Parliament offered them a new hat, in the shape of the Gas Regulation Act. It appeared to be a very good hat, but unfortunately it had not worn very well, and now let in the draught and badly wanted renewal. The sartorial condition of the gas industry was truly melancholy. It might be that Parliament—the universal provider—had no time at the moment to give a complete new suit of clothes; but surely there was time to provide the industry at once with a useful overcoat in the shape of a short Bill which would relieve the industry's needs until such time as the wardrobe could be fully replenished. The toast was coupled not only with the name of the Japanese Chargé d'Affaires, but also with that of the President of the Institution of Electrical Engineers, and he felt sure that in this respect the gas industry had the sympathy of Lieut.-Col. Edgcumbe. The electrical industry had no cause to complain of lack of Parliamentary attention. Indeed, at times, it seemed to be almost overburdened with legislative garments. Nobody who realized the plight of the gas industry would deny that it needed attention very urgently. If that were given, it would remove at any rate one of the conditions to which Lord Melchett referred in his moment of melancholy.

An Invitation to Tokio.

Mr. Sadao Saburi (Japanese Chargé d'Affaires) said his desire was to awaken a lively interest in the World Engineering Congress and the sectional meeting of the World Power Conference which were to be held in Tokio next autumn. His countrymen asked for nothing better than to accord a welcome to everybody in this country concerned with fuel if they could only find time to be in Japan. He realized, however, that this would be impossible, and therefore expressed the hope that those who could not contemplate so long a voyage would be kind enough to assist the work of the forthcoming conferences by the contribution of papers on subjects in which they were specially interested. These conferences had an immense portent for his country and his countrymen, because it would be the first occasion on which a world congress had assembled in Japan, and this circumstance alone would be a powerful incentive to his compatriots to redouble their efforts in furtherance of the cause of international understanding, and of the progress and happiness of mankind. On behalf of Prof. Kamo, of the Imperial University of Tokio, who was Chairman of the Organizing Committee of the conferences, he appealed for the co-operation of men of science in this country, and more particularly members of the Institute of Fuel. Japan had no large store of coal (enough, it was thought, for 40 years) and only a small amount of oil (a yearly output which satisfied no more than one-quarter of her actual needs). Thus the fuel problem in all its aspects was for Japan a vital one.

Lieut.-Col. K. Edgcumbe (President of the Institution of Electrical Engineers) also made response, remarking that fuel was of vital interest to the electrical industry; while the fuel industry was becoming more and more dependent upon the electrical industry. Therefore he felt that the Institute and the electrical engineers could do a great deal to further one another's work. One thing upon which the Institute deserved congratulation was that they had formed one organization out of two. At the present time the formation of technical societies was very nearly a disease. Indeed, in the electrical profession—particularly in the international field—it had become a regular epidemic; and the Institution of Electrical Engineers had felt compelled to draw-up a number of conditions with which any international body should comply if it asked for the support of the Institution. One condition was that there should be in each country a national Committee with whom the central body could communicate. He hoped other technical institutions would follow suit.

The Right Hon. J. H. Thomas, P.C., M.P., proposed "The President," and to this Lord Melchett replied—declaring that the Institute had a great part to play in the future prosperity of the country.

FORTHCOMING ENGAGEMENTS.

Nov. 30.—London and Southern District Junior Gas Association.—Meeting at the Westminster Technical Institute, 7.30 p.m. Paper by Mr. A. T. Green, F.Inst.P., A.M.I.Chem.E.

Dec. 1.—Western Junior Gas Association.—Meeting. Paper by Mr. C. C. Brice entitled "The Industrial Load in Bristol."

Dec. 1.—Manchester and District Junior Gas Association.—Meeting at Preston. Paper by Mr. A. K. Collinge, of the Preston Gas Company, on the "Working and Development of the 'Regenerative' Complete Gasification System."

Dec. 1.—Scottish Junior Gas Association (Western District).—Meeting in the Royal Technical College, Glasgow. Short papers by Mr. R. Lappin, of Glasgow, on "Street Lighting and Equipment;" and by Mr. J. Webster, of Port Glasgow, entitled "A Kodak at the Gas-Works."

Dec. 8.—Scottish Junior Gas Association (Eastern District).—Meeting and visit to the Leven Gas-Works and the Durie Foundry, Leven.

Dec. 8.—Wales and Monmouthshire Junior Gas Association.—Meeting, and visit to the National Oil Refineries at Llandarcy.

Dec. 12.—British Commercial Gas Association.—Meeting of the Executive Committee, 3 p.m.

Dec. 12.—Scottish Junior Gas Association (Western District).—Visit to the Union Works of the Scottish Tube Company, Ltd., Coatbridge.

Dec. 15.—Yorkshire Junior Gas Association.—Meeting at Leeds University. Paper by Mr. H. J. Hodsman, M.Sc., on "The Radiation from Gas Burners."

Dec. 19.—British Commercial Gas Association.—Meeting of the General Committee, 2 p.m.

Institution of Gas Engineers.

Dec. 4.—Finance Committee, 10.45 a.m.; Executive Committee, 11.30 a.m.; Council, 2.30 p.m.

Dec. 11.—Gas Education Executive Committee, 4 p.m.

SOCIETY OF BRITISH GAS INDUSTRIES.

AUTUMN GENERAL MEETING.

The Autumn General Meeting of the Society was held last Thursday, at the Hotel Cecil, Strand, London, W.C. The business proceedings were preceded by a luncheon, at which the Most Hon. the MARQUESS OF HARTINGTON, M.P. (the President), occupied the chair. By his side sat Prof. Arthur Smithells, C.M.G., F.R.S., and Mr. R. J. Milbourne, J.P., Assoc.M.Inst.C.E. (Chairman of the Council). Others at the top table were Mr. Charles Clare, Mr. Samuel Cutler, Assoc.M.Inst.C.E., Mr. C. A. Goodall (Vice-Chairman of the Council), Mr. B. B. Waller, Assoc.M.Inst.C.E., Mr. J. Wilfrid Drake, Mr. F. C. Tilley, Alderman George Clark, J.P., Mr. Frederick J. Gould, Mr. Cyril G. Davis, Mr. H. M. Thornton, J.P., Mr. E. J. Davison (Hon. Secretary), and Mr. Arthur L. Griffith (Secretary).

After luncheon, there were a few speeches. The Loyal Toast having been honoured,

THE PRESIDENT.

Mr. R. J. MILBOURNE remarked that he counted it an honour and a pleasure to have the privilege, as Chairman of the Council, of proposing the toast of "The President." It was no mere formal toast; it was one which every member would support with due sincerity and acclamation. Ever since the Society was founded, they had been able to secure the services of men distinguished in all branches of public life to preside over their gatherings, and they all felt very grateful and proud to have as their President for this year the Noble Marquess of Hartington, who, they knew, was so keenly interested in the industry and the public life of the nation. His year of office would, he felt sure, impress upon the Marquess the importance of the gas industry, which was one of the key industries of the country, as it supplied a commodity of prime necessity and of common use in the vast majority of the homes of the people, and was essential to a very large number of trades and industries. The coal used in the manufacture of gas was about 18 million tons per annum; while the capital invested in the gas industry was over £140,000,000.

OBSOLETE GAS LEGISLATION.

But although the industry was of such great importance and service, it was still being carried on under Acts of Parliament which were now entirely out-of-date and obsolete, and did not give them the powers required to meet present-day demands. It was a remarkable fact that the last important General Act dealing with gas was passed as long ago as 1871. This legislation was therefore enacted when the gas industry had a distinct monopoly; but at the present time it was placed in very severe competition with electricity. It was therefore high time that they obtained some revised and extended legislation, in the light of the changed conditions of the present day. This being so, they thought that the time had arrived for the Government to introduce a Bill for the removal of some of the many disabilities under which the industry was being carried on, and which limited the exploitation of the service that gas could render to the community; and he ventured to hope that when this matter came before the House of Commons they might count upon the President's thoughtful consideration and support. Such assistance would be appreciated by the Society and by the gas industry generally. In conclusion, he declared that the Society did feel very deeply the debt of gratitude it owed to the President, who, in the midst of a busy public life, was prepared to devote some of his time to helping the Society by occupying the Presidential chair. The members appreciated the tremendous assistance he had given them and their industry.

AN INDUSTRY WHICH HAS SERVED THE COUNTRY FAITHFULLY AND WELL.

The MARQUESS OF HARTINGTON said he was very grateful for the extremely kind way in which the toast had been proposed and received. He could assure the members that he counted it as a high honour to have been invited to be President of their Society, which had been, and was doing, such a great deal of immensely valuable work in connection with the gas industry—an industry upon which so much depended. It was an industry which had served this country faithfully and well, and it was an industry which had a very honourable record indeed in many ways—and perhaps more particularly in the relations which it had maintained with the manual labour side of gas production. He thought it was generally recognized in the House of Commons that the legislation which governed the gas industry was, in many respects, out-of-date; and he believed that the House would, when the Bill came before it, give it very sympathetic and very careful consideration. He could assure the members, for his own part, that he would count it a very great privilege indeed to do anything he could to help the gas industry to enjoy what it hardly had to-day—namely, a fair opportunity of competing with other industries dealing with commodities having the same purpose.

THE DE-RATING BILL.

This was not a political meeting, and he would be very wrong indeed if he attempted to carry on any political propaganda; but there was a Bill which would be before Parliament next week which was of the greatest importance to the industry with which the members were connected, as well as to the other industries of the country. He referred to the de-rating proposals of the Government—the Local Government Bill. He was not going to attempt to discuss this Bill or its merits. It was, he thought, a matter of common knowledge that the Bill was at the present time being very severely criticized in certain quarters of the Press, and he did ask the members not to take this criticism at its face value. It had been drafted after much consideration, and was a constructive measure of vast and far-reaching importance. Like every other measure, it no doubt had its disadvantages, as well as its advantages; but it did merit very much more careful consideration than it had been given in some portions of the Press. He therefore asked them to take the trouble, before accepting the criticism now appearing in some quarters, to study the Bill for themselves—it was not absolutely simple—[laughter]—and to form their own opinions on the effect which it was likely to have on the productive enterprises of this country.

THE VICE-PRESIDENTS.

Mr. C. A. GOODALL (Vice-Chairman of the Council) remarked that though the autumn meeting of the Society was a business one, they were afforded an opportunity of saying how delighted they were to have with them on these occasions some of those gentlemen whose work had helped to bring the Society to the position which it occupied to-day. They were much indebted to their Vice-Presidents and Past-Presidents for the time they had devoted to the affairs of the Society. With the toast he coupled the names of their old friends Prof. Smithells and Mr. Clare.

Prof. ARTHUR SMITHELLS, responding, said it was indeed a pleasure to be brought back among the industry with which he had had the

THE PRESIDENT.

The Most Hon. the Marquess of Hartington, M.P.

The Marquess is the eldest son of the Duke of Devonshire. He was formerly connected with the Staveley Coal and Iron Company, over whose Chesterfield Works he this year conducted King Faisal of Iraq. He is Hon. Colonel of the 6th Sherwood Foresters, and Captain in the Derbyshire Yeomanry. He saw service in Egypt, France, and the Dardanelles, and was twice mentioned in despatches. He was a member of the British Peace Delegation to Paris in 1919.

honour to be associated during the larger part of his professional life. He was glad to see the Society enjoying a prosperity which it owed so much to Mr. Clare. It was a peculiar pleasure to be there that day, because he saw the succession to the line of Presidents of the Marquess of Hartington. To no one could this fact make a stronger appeal than it did to him. The Cavendish family had provided science with one of its greatest chemists. His own association with the University of Leeds reminded him that the first President of the old Yorkshire College (later the University) was another member of the family, Lord Frederick Cavendish. The first occasion on which he saw the Marquess of Hartington was when he was acting as page and bearing the train of his father, who was the Chancellor of the University. In rendering service, the great family of Cavendish could always be counted upon; and it was a peculiar satis-

faction to him that this spirit of service was now being manifested, through their Society, in relation to the gas industry.

Mr. CHARLES CLARE, who also replied, said the Society had done good work, and there was more good work for it to do in the future. He was sure their hopes in it would not be disappointed.

BUSINESS MEETING.

The business meeting was afterwards held in the hotel—the MARQUESS OF HARTINGTON (the President) in the chair.

Mr. R. J. MILBOURNE (Chairman of the Council) read the following:

Report of the Chairman of the Council, covering the work of the Past Six Months.

It is customary at our Autumn General Meeting for the Chairman of the Council to give a short report on the Society's work during the past six months.

We have to record with much regret the following deaths: Mr. John E. Williams, Chairman of Messrs. John E. Williams & Co., Ltd., and one of the Founders of the Society; Mr. Peter Robertson, Editor of the "Gas World;" and Mr. Arthur F. Bezant, Editor of the "GAS JOURNAL," whose counsel and advice were always of great value to the Society. I also have to record with much regret the death a few days ago of Mr. F. G. Cockey, who for many years was an active member of the Council. At one time he occupied the position of Vice-Chairman of the Society, but unfortunately pressure of business prevented him from accepting the Chairmanship. As a mark of respect to those who have passed away, I will ask the members to stand silently.

The Society wishes to offer its hearty congratulations to the Right Hon. Lord Melchett, one of our Past-Presidents, on the honour of a Peerage conferred upon him by His Majesty the King.

We are much indebted to our Past-President, His Grace the Duke of Sutherland, for his very able address at our Annual Meeting in May. The address dealt with the national position in regard to fuel, especially with reference to the oil and coal industries, and the importance of co-operation between the gas industry and the coal industry.

The Annual Meeting was a very successful one, and at the dinner we were honoured by the presence of a number of distinguished guests. We are fortunate on this occasion in having our new President, the Most Hon. the Marquess of Hartington, M.P., in the chair, to whom we accord a very hearty welcome.

ECONOMIC COMMISSION TO AUSTRALIA.

It was with much gratification that we learnt that His Majesty's Government had appointed Sir Arthur Duckham, K.C.B., Leader of the Economic Mission to Australia; it is a great compliment to him and to the gas industry. We extend to him our very hearty congratulations, and best wishes for every success in his mission. It is hoped that the conferences with the producers and industrial leaders in Australia will result in a great increase of trade with Great Britain.

LEEDS UNIVERSITY.

At the laying of the foundation stone of the new buildings of Leeds University, by Her Grace the Duchess of Devonshire, we were represented by our Vice-Chairman, Mr. C. A. Goodall.

WORLD POWER FUEL CONFERENCE.

The Society, as one of the constituent bodies of the World Power Conference, British National Committee, views with satisfaction the large measure of success attained during the meetings held at the Imperial Institute, London, from Sept. 24 to Oct. 6. Many of our members attended, and your Council is of the opinion that the Organizers are to be congratulated on the results achieved. Especially would we wish to offer congratulations to one of the Joint Secretaries who is a member of our Council—Dr. E. W. Smith. The Chairman of the Council for the time being has been appointed our representative on the British National Committee of the World Power Conference.

BRITISH INDUSTRIES FAIR, 1929.

Excellent progress is being made in the organization of the Gas Industries Section to be held at the British Industries Fair, Birmingham, from Feb. 18 to March 1, 1929.

The space allocated by the British Industries Fair Committee to the Gas Industries Section amounts to 19,528 sq. ft. of actual stand space, all of which, I am glad to hear, has now been taken up. It is gratifying to find that members of the Heavy Groups of the Society are this year taking space at the Fair.

The Local Exhibition Sub-Committee has met in Birmingham, and has agreed upon a uniform colour scheme which is being adopted by exhibitors. An open type of stand, based on the same general design, will also be adopted throughout the section.

At the instigation of the President of the Institution of Gas Engineers, a Joint Conference Committee has been set up, consisting of representatives of the National Gas Council, the Institution of Gas Engineers, the British Commercial Gas Association, and the Society, to make the necessary arrangements for the holding of a Gas Conference during the period of the Fair. It is anticipated that a special conference hall will be erected adjacent to the Fair Buildings, and it is hoped that in this the meetings of the special Joint Gas Conference will take place. [I am pleased to say that the Fair Authorities have, since this report was drawn up, decided to erect a suitable conference hall.] In addition to the Joint Conference, arrangements are being made for a meeting of the Association of Public Lighting Engineers, who will pay an official visit to the Fair. It has also been decided that the annual meeting of Gas Salesmen shall take place in Birmingham during the Fair. Everything points to a record attendance of gas engineers next February at this great national fair.

Mr. A. W. Glover has been elected a member of the Joint Committee, in place of Mr. H. Talbot (retired).

BRITISH ENGINEERING STANDARDS ASSOCIATION.

This Association, which has recently applied for a Royal Charter, has intimated its intention of giving representation to both sides of the gas industry—namely, the Institution of Gas Engineers, and the Society—to be named "The Gas Industries Sectional Committee." We have accordingly nominated four representatives on the Committee.

NEW FORM OF BUILDING CONTRACT.

The interests of our members likely to be affected are being carefully watched, and further developments are awaited.

INTERNATIONAL COMMISSION ON ILLUMINATION.

Mr. Harold Talbot, Chairman of the Lighting Section, was nominated to represent the Society at the meetings in New York in September, but unfortunately, owing to unforeseen circumstances, was unable to go out. Mr. Robert Watson, of Doncaster, who represented the Institution of Gas Engineers, with the consent of the Institution kindly represented us as well. Mr. Watson has prepared a full report for publication, and we as a Society are deeply indebted to him for having represented us upon this occasion.

ILLUMINATING ENGINEERING SOCIETY.

To show our interest in the work of the Illuminating Engineering Society, we have recently become "sustaining members," and have given financial support. Mr. Frederick J. Gould has been nominated as our representative.

PUBLIC LIGHTING ENGINEERS' CONFERENCE.

At the Annual Conference, at Sheffield, in July, of the Association of Public Lighting Engineers, the gas industry was very well represented. Some of our members loaned for inspection street lighting installations conforming to the British Standard Specification for Street Lighting which was recently issued; and the tests were very satisfactory.

LIGHTING LOAD.

Efforts are in progress to stimulate increased interest in the use of gas for lighting; and active steps are being taken in this direction. A Sub-Committee has been appointed to meet the Committee appointed by the British Commercial Gas Association to discuss the matter.

We much regret to announce the resignation of Mr. Harold Talbot, Chairman of Section VII., owing to his having severed his connection with the Welsbach Light Company, Ltd.; and we accord our best thanks to him for his valuable services to the Society. Col. E. A. Wilson, a Director of Messrs. Evered & Co., Ltd., has been elected Chairman of the Section until the annual meeting next year.

GAS COAL SECTION.

There have been one or two meetings of the Coal Section, when the members have discussed the probable effects of the various new schemes now in operation, and suggested, for the organized marketing of coal.

REVISION OF RAILWAY CLASSIFICATION OF GOODS.

Messrs. Tweedy & Holt, our Railway Experts at Halifax, continue to watch our interests; and their reports keep us in touch with railway matters.

The Prizes in the City and Guilds of London Institute Examinations in Gas-Works Practice, Gas Supply Practice, and Gas Fitting have been duly awarded, and announced in the Technical Press.

The membership of the Society is steadily increasing. Four new firms have joined during the period under review; and I am pleased to say there are now applications from other firms under consideration by the Council.

IMPORTANCE OF THE LIGHTING LOAD.

Mr. MILBOURNE, having read the report, proceeded: Before finally moving the adoption of the Council's report, I should just like to make a few personal remarks on the question of gas lighting, as I am still convinced that our kindred Association should devote a little more of its substance upon retaining and extending this particular branch of the gas industry. If displayed advertisements are useless without being backed-up by intensive service and maintenance, then by all means let us

have such a service. I quite agree that if a man has poor burners, badly maintained by his local gas undertaking, it will be a difficult matter to persuade him to use gas for lighting; but the same argument holds good as to cooking and heating by gas, yet we advertise cookers and gas stoves. I do not question the statement that electricity is preferable as a lighting agent in a number of large houses—especially in the well-to-do London area—but there are a considerable number of medium-sized and small homes, particularly in the provinces, where economy is a prime consideration, and where a large number of gas undertakings are successfully maintaining gas lighting and introducing it into many newly-built houses. We must not lose sight of the fact that the gas industry offers its services to all classes of consumers, and that we must be prepared to provide for the needs of the working-class families as well as the rich.

The absence of advertisements of domestic gas lighting is frequently commented upon; and when a gas manager is striving to maintain the lighting load by constant inspection of burners and fittings, installing up-to-date lighting apparatus, and drawing his consumers' attention to the advantages of gas lighting, which are many, and particularly in relation to general health and sight, it is surely not too much for him to expect some such assistance from the Association as he gets for his cooking and heating load. It is not very helpful for him to receive a copy of "A Thousand-and-One Uses for Gas," Vol. XVI., No. 176, showing a nicely furnished room fitted with a gas fire, and illuminated by an electrical pendant, such as I have here. These advertisements suggest that electricity is preferable in a room which is gas heated; and it is obviously unfair to him and to the members of this Society who manufacture lighting fittings. ["Hear, hear."]

It must not be overlooked that in a large majority of homes the consumption of electricity for lighting alone is too small to make it commercially profitable for the electricity company to lay a service cable, and maintain a supply, unless they have some prospect of increasing the consumption; and consequently our electrical friends are now using all their persuasive powers, by advertisement and personal calls, to induce the occupiers to cook, heat, and light by electricity. Therefore, if they succeed, we shall in a number of cases lose the cooking, heating, and lighting. Gas an an illuminant has many advantages. It assists in the warming of the room; it is undoubtedly superior to electricity if looked at from the point of health alone; it is generally cheaper; and it most certainly is more dependable than the electric light. We never hear of the gas going out. I am an optimist and a firm believer in gas as an illuminant; and its possibilities should not be overlooked. Therefore we must continue "Fighting for the Lighting."

British Industries Fair, Birmingham.

I am pleased to say that the Gas Section at this Fair, which has been organized by our Society, promises to be a great success. The whole of the extended space, amounting to over 19,000 sq. ft., allocated to the Gas Section, has been taken up. The President of the Institution of Gas Engineers, Mr. John Terrace, has organized a three-days' joint conference, to be held in the new conference hall which is being erected in the Fair grounds. Invitations to attend will be extended to all members of the Institution of Gas Engineers, the Society of British Gas Industries, the National Gas Council, and the British Commercial Gas Association, so that the gathering will no doubt be numerically the largest conference yet held in the interest of the gas industry. The dates have been fixed for Feb. 19, 20, and 21; and the proceedings will be opened each morning at 10.30 by Mr. Frank H. Jones, M.Inst.C.E., President of the "B.C.G.A." An official luncheon will be given by the Fair authorities to those attending the conference; and I earnestly hope that all the members of our Society will make an effort to be present.

I beg to move the adoption of the report.

Mr. C. A. GOODALL (Vice-Chairman): I have much pleasure in seconding the motion. Mr. Milbourne is certainly a very good advocate for those members of the Society who are looking after the lighting load, and I am sure what he has said will receive strong support. This is the sort of thing we come across—in the "GAS JOURNAL" for June 13 of the present year the following appeared:

> DESIRE FOR GAS LIGHTING.—An application was recently made by a number of tenants in Corporation houses at Greenock to have gas installed for lighting purposes in place of electricity. When the matter came before the Corporation, it was agreed to submit the proposal to the Board of Health, and a reply has been received in which the Board refuse to sanction any alteration.

Another Corporation in the Midlands passed a resolution that all tenants in Council houses should be made to take electricity. This shows the strength of the opposition we are up against in connection with the lighting load. It is for this Society to do all it possibly can to assist the gas industry to carry through legislation which shall stop such a veto as that being put on us. It was with that idea that we were approached to appoint a Committee to work in conjunction with them. Your Council concluded it was right and proper. They appointed a Committee, who are now endeavouring to see what can be done to give gas its due place.

CHAIRMAN OF THE COUNCIL.

Mr. R. J. Milbourne, Assoc.M.Inst.C.E., is the Managing Director of Messrs. C. & W. Walker, Ltd.; Vice-Chairman of the Wellington (Salop) Gas Company; Director of the Elstree and Boreham Wood Gas Company; Director of the Ferro-Concrete Construction Company, Ltd.; Director of Dry Gasholders, Ltd.; Chairman of the Governors of the Walker Technical College, Oakengates, Salop; and Justice of the Peace for the County of Shropshire. After serving his engineering pupilage under the late Charles & William Walker, he was for several years Chief Technical Assistant to Mr. F. Southwell Cripps, Assoc.M.Inst.C.E., Consulting Gas and Water Engineer, of Westminster, and afterwards joined the firm of Messrs. C. & W. Walker, Ltd., at Donnington. Mr. Milbourne is well known throughout the gas industry as an inventor of gas plant, and as a frequent contributor to the Technical Press. He was engaged by the Editor of the "Encyclopædia Britannica" to write the article on "Gasholders" for the new Fourteenth Edition which is now being published.

No questions were raised, and the report was unanimously adopted.

Gasholder Sheeting.

Mr. MILBOURNE then delivered his address entitled "Gasholder Sheeting." This, together with a report of the extended discussion to which it gave rise, will be found elsewhere in this issue.

British Industries Fair.—An increase of over 300 p.ct. in the number of overseas buyers who have promised to attend the next British Industries Fair was revealed last week by Mr. Douglas Hackling, M.P., Minister of the Department of Overseas Trade, as a result of a comparison made with the replies received up to the corresponding date last year. There is also a 100 p.ct. increase in the number of replies stating that the United Kingdom agents of overseas firms have been instructed to attend the Fair. The Fair is to be held at White City, London, and Castle Bromwich, Birmingham, from Feb. 18 to March 1.

Southern District (London Area) Salesmen's Circle.—The next meeting of the Circle will be held at 28, Grosvenor Gardens, S.W. 1, at 7 p.m. on Tuesday, Dec 4. The programme for the meeting is of particular interest. Mr. H. W. Kerridge, of the Croydon Gas Company, is to read a paper on "Domestic Coke Sales." Mr. E. W. L. Nicol, the Fuel Expert of the London Coke Committee, will open the discussion on the paper; and Major J. E. Blow, Coke Sales Manager of the South Metropolitan Gas Company, has also promised to take part in the discussion, with particular reference to the "Metro" coke burning grate.

A NEW GAS FIRE RADIANT.

RADIATION LIMITED INTRODUCE THE "THERMO-XX BEAM" RADIANT.

Comfort Value of Short Wavelength Energy.

On Thursday last, at Radiation House, Grosvenor Place, S.W., before many distinguished scientists and medical men, Mr. H. James Yates, the Chairman of Radiation Ltd., introduced a new gas fire radiant which is calculated to enhance the popularity of the gas fire and render the latter term synonymous with heat comfort. For several years Radiation have been investigating the therapeutic properties of gaseous heating; and the "Beam" radiant—a development which may mark the dawn of a new epoch—is the first practical outcome of their intensive research.

Mr. H. JAMES YATES, addressing those present, said: It is more than a century since coal gas was first supplied as a public illuminant, and this great public utility service touches the lives of all of us at some point. Gas heating is a much more recent development than gas lighting; nevertheless about two-thirds of the gas sold to-day is used for the direct generation of heat, and especially for domestic cooking or room heating. The gas required for this purpose involves a consumption of roughly 12 million tons of coal per annum at the gas-works. If the thermal energy were developed by the direct burning of coal in the domestic grate, a still larger amount of fuel would be needed, and this in its turn would add to the annual toll of victims from the "diseases of darkness," and increase the "black smoke tax" which falls on all city dwellers. The gas stove, then, plays an honourable part in improving conditions in our large cities and towns; and as this development owes a definite, though indirect, debt to the medical profession, and especially to the medical research worker, I feel that little in the way of explanation will be required from me for the invitations sent to you to visit us. In its earliest form the gas stove was a lamentably unscientific affair, and the medical man denounced it as unhygienic. When you visit our Central Research Laboratories you will see one or two examples of gas fires of earlier design, and, by contrasting these with the latest types, will attain an idea of the strides forward which have been made as a result of applying scientific knowledge and method to the development of the appliance.

QUALITY OF ENERGY.

The average modern gas fire satisfies a high hygienic standard—the "Lancet" test will be familiar to all of you—it ventilates adequately, is silent in operation, and is efficient. What room is there, then, for further improvement, apart from details? Some years ago, when faced with this question, we decided to initiate an investigation to determine whether, by effecting change in the quality of the energy emitted by the fire—*i.e.*, a change in the frequency of the energy—any improvement could be effected in the degree of comfort attained.

At the outset, we had two facts which suggested that research along the lines indicated might not prove unfruitful. First, the human system responds most satisfactorily to the sun's energy, and the solar spectrum differs markedly from that of a domestic fire. Secondly, the sensation experienced when seated in front of the gas-fire, electric radiator, or a glowing coal fire was not as pleasant as that experienced in the sun. Admittedly, this difference might not be unconnected with atmospheric conditions, the importance of which are now realized—largely owing to the results of the researches of Leonard Hill and his co-workers—but, in addition, we had experience of a few cases of people who responded unfavourably to the gas fire, and yet revelled in the energy from a flaming coal fire. This difference was not due to any escape of products of combustion from the gas fire, nor could it be due to any peculiar effect on the air of the room, but must in some way be connected either with the intensity of the radiant energy received on the body or with the quality of that energy. We have endeavoured to arrive at an understanding of the factors which determine the state of comfort, and though we cannot, of course, claim to have solved this intricate matter, it is hoped that the results which are shown in our laboratories will interest, and even, perhaps, stimulate, some of you. Even if you do not agree with our interpretation of the phenomena, you will, I hope, at least feel that the result we have attained, so far as the gas fire is concerned, is a useful contribution to the improvement of the means available for domestic heating.

A LIGHT-EMITTING RADIANT.

We have produced a new radiant which is noticeably more incandescent, and as a result emits a higher percentage of visible and near infra-red energy than has been attainable hitherto with the gas fire. Tests carried out by ourselves on a number of people of both sexes have shown that, for a given intensity of emitted energy, longer exposure to a fire fitted with the new radiants than to one fitted with earlier types of radiant can be borne with comfort. The difference is marked in cold, dry weather. Further, people who find the heat of the ordinary gas fire trying, expose themselves with pleasure to the rays from the new radiant. The fact that more prolonged exposure to a fire fitted with the new radiant can be borne than to a fire fitted with ordinary clay radiants has been confirmed by Prof. Leonard Hill, to whom we submitted fires for independent examination.

In this phase of our research work we are blazing a trail so far as the gas fire is concerned, and as yet we are, I think, really only on the fringe of this development, which is enabling us to impart more of the quality of the sun's heat to the energy emitted by one of the most important types of domestic heater in use in this country. I may perhaps be regarded as not too extravagant if I say that our ultimate ideal is to bring eternal sunshine into every home; and with that sunshine the peculiar qualities of warmth, energy, and health which we in these northern islands so sorely miss at this time of the year.

Artificial light baths are now much used and, no doubt, abused; and my medical friends tell me that, in connection with these light baths, the judicious application of radiant heat is a useful aid. Sonne, of the Finsen Institute, has even expressed the view that the curative value of the light bath itself is closely connected with the power of the visible energy it emits, to penetrate into, and warm directly, the bloodstream. The possibility of replacing the carbon arc lamp by the gas fire is not in sight; but by imparting to the energy which the latter emits some of the penetrative quality of the sun's rays, we are adding to its value as a therapeutic adjunct to the ultra-violet light bath.

The combustion of a hydrocarbon with the production of steam is characterized by an emission of energy in the region of 3060 Angstrom units, and the spectrogram of the new fire shows the presence of ultra-violet energy extending down to about 2800 Angstrom units, but the amount is very small compared with the visible and infra-red energy emitted; and it is to increase in the visible and near infra-red energy that we look for further improvement in the gas fire.

CONGRATULATIONS FROM PROF. LEONARD HILL.

Prof. LEONARD HILL, congratulating Radiation Ltd. on the important results which they had achieved by their research work, said how important it was for the great commercial undertakings to have behind them properly equipped scientific laboratories; for progress could only be achieved by the application of scientific principles. He had carried out some research work on the question of radiant energy, and was highly interested in the subject. Sonne had demonstrated that the visible rays penetrated the skin more deeply than did the infra-red heat rays. If a thermo-junction be applied to the skin, the latter exposed to visible rays, and the infra-red rays taken out by a water screen, then it could be shown clearly that a man did not experience discomfort until a temperature of 48° C. was attained under the outer epidermis. On the other hand, if the skin were exposed to dark heat rays, the bearable temperature—in this case a surface temperature—was much lower. As a matter of fact, the figure was 43·5° C., a difference of 4·5° C., which was most remarkable. Prof. Hill said that he had tested the new radiants; and his investigations had shown that they gave out more visible rays than did the usual type of radiant, and that the effect of the heat was far more pleasant with the new pattern. His explanation of this was that the rays of short wavelength penetrated through the outer layer of the skin, acted on the nerve endings, and excited sweating—either sensible or insensible. Consequently, when exposed to the new radiant, the skin was moist; and the moisture acted as a protection against the infra-red rays. The results obtained in the laboratory of Radation Ltd. were of the greatest interest; and he hoped that the new radiant would extend the use of gas for heating purposes.

A SERIES OF DEMONSTRATIONS.

Thereafter those present inspected the work which has been, and is being, conducted in the Central Research Laboratories. Examples of old gas fires, demonstrating the developments in gaseous heating during the last thirty or forty years, were on view; and two modern fires showed the difference between the ordinary radiant and the new "Thermo XX Beam" radiant. The work of the new radiant was explained by a series of about eighteen diagrams, each of which had a suitable legend explaining not only the investigations carried out, but the reasons for the results achieved. Both the physical and the physio-

logical aspects were considered. Other demonstrations included an injector-ventilator fire, and ventilator data showing the results attained with the modern fires, and the value of the "injector-ventilator" principle; the apparatus used in connection with recent carbon monoxide research work; a spectrometer employed in connection with the examination of the quality of the energy emitted by different heating appliances; and apparatus for determining radiant efficiency, measuring comfort sensations attainable with the new as compared with the old radiant, determining subcutaneous temperatures, and detecting sweating.

We will now consider the new development in more detail.

Radiant Heat and Comfort.

There are two alternative means of supplying thermal energy to a living-room—namely, either by radiant heat or by convected heat. In the former case, the heat is conveyed directly from the source to the body, and is not greatly influenced by the intervening air. In the second case, the body is immersed in a heated atmosphere, and the transference of heat is made by direct contact with hot air.

It is agreed that under the climatic conditions prevailing in this country, the use of radiant heat permits of greater comfort being attained than with convected heat; and in recent years the gas fire has been developed so as to increase the amount of radiant heat emitted by it, as well as to improve its ventilating effect. It is noticeable, however, that the radiant heat emitted by domestic fires differs in some way from the heat emitted by the sun, to the effects of which the human system responds most satisfactorily.

A determination to explore all possible lines of development led Messrs. Radiation some years ago to initiate an investigation, to see whether improvement could be effected in the quality of the heat given by gas fires and similar sources of radiant energy. Prior to this time, the possibility of improving the degree of comfort by changing the quality of the energy emitted by the gas fire would appear not to have been envisaged.

The Structure of the Skin.

On the outer surface of the body is the dead horny layer of the epidermis, which varies in thickness from 0·02 mm. to 0·5 mm., and underneath are the living cells of the epidermis, in layers of thickness corresponding to the horny layer. The total thickness of the whole epidermis varies in general between 0·1 mm. and 1 mm., but may be even thicker in some people. Beneath the living cells is the derma, or true skin, in which blood circulates through a closely woven network of capillaries, in streams about 0·01 mm. thick. The nerve endings are in the living cells of the epidermis and in the derma. The derma is in general of the same order of thickness as the epidermis. The total thickness of the skin (epidermis and derma) varies between 0·5 mm. and 3 mm., but on the back and shoulders it may attain thicknesses as great as 5 or 6 mm.

The Effect of Radiant Energy on the Body.

The reaction of the body on exposure to radiant energy is affected by various factors, among which are the following:

(*a*) *The Intensity of the Energy.*—When the intensity is excessive, "burns" may be produced on the surface of the skin, and blistering may result, though with ultra-violet rays it may not be immediately obvious that there has been over-exposure, and the blisters may not appear until some hours after exposure. With ultra-violet rays blistering can be produced, even though the surface of the skin be artificially cooled.

(*b*) *The Quality of the Energy.*—When other conditions are the same, a greater intensity of sun energy can be withstood without discomfort, than of the energy emitted by an ordinary red-hot body.

(*c*) *The Condition of the Skin and the Environment.*—When the body is exposed to the influence of radiant heat, a natural protection for the skin is provided by sweating. The water which collects on and in the surface layers arrests part of the energy, and may prevent burning. The cooling due to the evaporation of the moisture also has a great effect on the heat sensation produced. It is known that ideal conditions out of doors are given by warm, strong sunshine and cool moving air. If the atmosphere be humid and hot, the body reacts more unfavourably than in a dry and hot atmosphere, because of the difficulty of evaporating sweat.

When the body is exposed to ultra-violet rays, the energy is absorbed by the layers of the skin and, by suitable treatment, considerable benefit may be derived. The "biologic" effect of ultra-violet rays is widely known. It is not generally realized, however, that visible energy and the shorter infra-red rays have a definite "stimulative" value, usually attributed to the power they possess of penetrating the outer layers of the skin.

Penetrability of Radiant Energy.

The visible and shorter infra-red energy can penetrate more deeply into the body than the longer infra-red rays. This view is supported by the work of Sonne (confirmed by Leonard Hill and Argyll Campbell), who found that, when the body is exposed to red or short infra-red rays, subcutaneous temperatures may be attained, which are not only much higher than the normal blood heat, but which, in certain circumstances, are actually higher than those attained at the same time on the surface of the skin; whereas, when the body is exposed to long infra-red energy, the subcutaneous temperature is always lower than the surface temperature.

The penetrability of infra-red rays is much influenced by the amount of water on the surface, as well as the actual water content of the skin. Julius, Paschen, Aschkinass and others have studied the transmission of radiant energy through thin layers of water and have found it extremely opaque to infra-red rays. The opacity in general increases with the wave length, and for wave lengths greater than 2μ, water is exceptionally opaque.

In the Laboratory of Radiation Ltd. examination of the penetrability of wet rabbit-bladder-membrane has shown that with infra-red energy the diathermancy also decreases sharply with increasing wavelength; the influence of the water being conspicuous.

To obtain information regarding the penetrability of the horny layer of the epidermis, the transmission through thin sheets of clarified ox horn, about ¼ mm. thick, was first examined. The material proved to be very opaque to the long infra-red rays, and especially to rays in the region of 3μ. Desquamated horny layer of human epidermis, on the other hand, behaved as though more transparent to the longer than to the shorter infra-red rays. This result may in part be due to the fact that the specimen examined, which was about 1/20 mm. thick, was considerably pigmented. It had been obtained by giving the body an overdose of ultra-violet light, and appeared a light brown colour by transmitted light.

When the skin is exposed to a source of heat, the long infra-red rays may be very completely absorbed by the moisture in the surface layers whence the heat is transmitted to the underlying tissue by conduction. The visible and short infra-red rays, on the other hand, in part penetrate to, and are absorbed by, the living cells of the skin, and the blood circulating in the capillaries. The visible red rays may penetrate very deeply, not being wholly absorbed by the blood and tissues of the skin. A glow-lamp held in the mouth in a dark room causes a faint red shine in the cheek of a white man. This does not occur with a negro. The pigment in the epidermis of a negro absorbs the visible rays and protects the blood from overheating.

Comfort.

The fact that a higher intensity can be borne of incident energy of the visible or short infra-red quality than of the long infra-red is thought to be due to the greater penetrability of the shorter rays. The energy emitted by the sun contains more visible and short infra-red energy than that emitted by a domestic fire; and this fact would appear to explain why it is possible to bear in comfort more sun energy than of the energy produced by an ordinary red-hot body.

The Need for More Short Infra-Red Energy.

The considerations mentioned indicate a direction of possible improvement in the gas fire. In view of the water content of the skin and body tissue, it is clear that, if the heat emitted by a gas fire can be made to contain more of the visible and short infra-red energy, at the expense of the long infra-red quality, an energy of a more penetrating nature will be obtained; and as a higher intensity can be borne when the heat is in the form of the shorter wave length energy, the resulting appliance will permit of a higher degree of comfort being attained. While increasing the amount of short infra-red radiation at the expense of the long infra-red, it is desirable to avoid an excessive increase in the intensity of visible energy emitted by the source, as in that event "glare" would be experienced when seated in front of the appliance.

The "Thermo-XX Beam" Radiant.

It was considered essential that, if possible, any developments should in the first instance be made applicable to all Radiation standard fires previously marketed. For this reason it was decided to work on the radiants; and it has been found possible to effect a modification in their composition, which has resulted in improvement in the quality of the energy emitted by the gas fire. The new radiant, which Messrs. Radiation have had in domestic use now for some two years, represents the first development in this line of research which they have initiated. It has been named the "Thermo-XX Beam" radiant, and is made of a form very similar to the original "Thermo-XX" radiant, and is strictly interchangeable with it. Compared with the original clay radiant, the "Thermo-XX Beam" radiant produces noticeably more light, though not so much as to affect the eyes unpleasantly; and there is also a distinct difference in the effect of the heat on the body. The heat attainable with the "Thermo-XX Beam" radiant is a "softer" heat, and has a less scorching effect, and in consequence promotes a feeling of greater comfort than has been

attainable previously with gas fires. The difference in the effect is especially noticeable in dry, cold weather.

SUBCUTANEOUS TEMPERATURES.

The penetration of radiant energy into living human tissue is difficult to measure quantitatively. Experiments have been made to determine the temperatures attained at a depth of some 2 mm. below the surface of the skin. By suitable exposure to a " Thermo-XX Beam " radiant fire, depth temperatures of 110° to 112° Fahr. were attained with the production of reddening, but without noticeable whealing. The normal blood temperature is 98·6° Fahr.

The attainment of these high temperatures was found to depend on a number of factors, such as the humidity conditions of the atmosphere, the air temperature, the general tone of the body, and the facility, or otherwise, with which perspiration is produced. Inability to control adequately these various factors renders it difficult to obtain reliable comparative quantitative measurements on living tissue using different sources of heat.

TRANSMISSION DATA.

The determination of the transmission of energy through dead skin is also complicated by the drying of the tissue which results during exposure to the source of heat.

Using the bladder-membrane from a freshly killed rabbit, it was found that 14·6 p.ct. of the energy emitted by a fire fitted with "Thermo XX Beam " radiants was transmitted on first exposure of the membrane, and that, as drying of the membrane took place, the transmission increased to about 45 p.ct. In the case of a shaven stomach skin (epidermis and derma) from a freshly killed rabbit, the initial transmission was 6·1 p.ct., and as the skin dried this increased to 20 p.ct.

Through a piece of ox-horn (about ¼ mm. thick), there was transmitted 20 p.ct. of the incident energy.

A fresh piece of desquamated horny layer of human epidermis was found to permit of the transmission of 40 p.ct. of the incident energy.

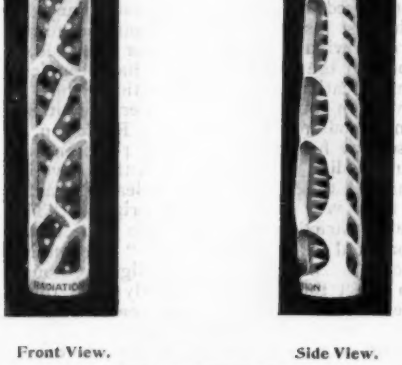
Three pieces of human skin (epidermis and derma, female breast) removed from an elderly patient during an operation, were examined and found to permit respectively of the transmission of 2 p.ct., 1·5 p.ct., and 4·5 p.ct. of the incident energy, when exposed to a fire containing " Thermo XX Beam " radiants. The three specimens varied somewhat in thickness, and possibly also in their water content. The whole of the under-fat had been removed from the skins, but the specimens were streaked with blood. As drying took place there was a marked increase in the diathermancy of the samples. Experiments have shown that the opacity of dead tissue to near infra-red and luminous energy at first decreases and then increases again with the passage of time.

Allowing for the thickness of the living human skin, it appears that, while a considerable proportion of the radiant energy passes directly into the living cells of the epidermis, some may pass directly into the derma. The heating of the blood stream in the capillary vessels in and beneath the papillæ, resulting from the direct transmission of radiant energy, as distinct from that due to conducted heat, must, however, only be small for many parts of the body. Where the skin is thin—as, for example, on the face, neck, and forearms—which are usually exposed to the fire, there is, as indicated previously, a small direct transmission of radiant energy even into the tissue below the skin.

Experiments carried out in dry, cold weather on a number of persons of both sexes indicated an increased comfort attainable with the new radiant. In each case, the flexor side of the fore-arm was exposed to the source of heat, one arm in front of a gas fire fitted with ordinary clay radiants, and the other to a fire fitted with " Thermo XX Beam " radiants. While the period of heating which could be borne without discomfort varied with different persons, it was found that a longer exposure to the " Thermo XX Beam " radiant fire could be endured. It appeared also that after prolonged heating, the arm which had been exposed to the " Thermo XX Beam " radiants was in general less painful than the arm exposed to the fire containing the ordinary radiants.

By the transpiration of moisture or sweating, a natural protection for the skin, against the effects of an overdose of radiant energy, is provided. On subjecting the flexor side of the fore-arm to an overdose of radiant heat, it has been found, especially in humid weather, that the intense pain produced may be suddenly relieved, and replaced by a feeling of comfort consequent upon sweating at the exposed surface. Our experiments suggest that the greater feeling of comfort which is produced by certain sources of radiant heat is due, in part at least, to the excitation of the nerves which promote sweating or transpiration of moisture, with the consequent production of a pleasant, moist, warm skin in place of a dry burning one. Undoubtedly, the water content of the skin has a predominating influence on the effects produced by radiant heat.

The " Thermo XX Beam " radiant represents only a first step forward in the direction of improving the quality of the energy emitted by a gas fire. Messrs. Radiation felt, however, that the advantages which this radiant possesses, in improving the appearance of, and the degree of comfort attainable with, the gas fire, warranted its production.



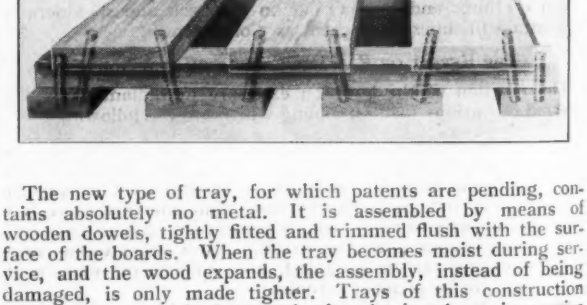
Front View. Side View.

" Thermo XX Beam " Radiant.

NON-CORROSIVE PURIFIER TRAY.

A new type of purifier tray which successfully resists the corrosive action of gas is being manufactured by the Semet-Solvay Engineering Corporation of New York, under exclusive contract with the designer.

The new tray is the invention of Mr. F. C. Wellington, of Chicago, for several years Superintendent of the Illinois Power Company's gas plant at Springfield, Ill. Mr. Wellington designed a tray that would successfully withstand the corrosive effect of the sulphur which is taken out of the gas in the purification process. Sulphur has always shortened the serviceability of purifier trays by eating away the bolts, screws, or nails used in assembling.



The new type of tray, for which patents are pending, contains absolutely no metal. It is assembled by means of wooden dowels, tightly fitted and trimmed flush with the surface of the boards. When the tray becomes moist during service, and the wood expands, the assembly, instead of being damaged, is only made tighter. Trays of this construction which were recently inspected after having been in service almost two years were found to be in perfect condition, requiring no repair whatever.

SCOTTISH JUNIOR GAS ASSOCIATION.

(WESTERN DISTRICT.)

Through the courtesy of the Clyde Valley Electrical Power Company, about forty members of the Scottish Junior Gas Association (Western District) on Nov. 17 visited the Stonebyres Power Station. The party were met on arrival by the Station Engineers, Messrs. Croucher and Bowman, who explained fully the method of " harnessing the Falls of Clyde."

The tilting weirs which automatically compensate for either flooding or scarcity, by allowing more or less water to escape, and by so doing keep the " head " constant, were the first source of interest. This part, called the " intake " works, is connected by means of a tunnel with the power house proper; the water passing through a " surge " tank which takes up small variations in supply and demand prior to entering the turbine generators.

At the conclusion of the inspection, the visitors were entertained at tea, after which Mr. R. FIFE (Kilmarnock) expressed the thanks of the Association for the pleasant manner in which they had been received.

GASHOLDER SHEETING.

By R. J. MILBOURNE, Assoc.M.Inst.C.E., Chairman of Council, "S.B.G.I."

[An Address at the Autumn Meeting of the Society.]

Several years ago I endeavoured to press forward a suggestion for some responsible and effective research work being undertaken by our combined efforts with regard to the cause and prevention of corrosion in gasholder sheeting. Owing to the very limited time available on that occasion, it was not possible to enter into the subject at any great length; and though the proposal then briefly outlined received some measure of support, the subject has not yet received the attention which I venture to think its importance demands. I therefore purpose taking advantage of my present position as Chairman of the Society of British Gas Industries to bring forward the subject again in the hope that such an important matter will receive our combined consideration.

The tendency of wrought iron and steel to corrode under certain conditions has been recognized from the earliest use of these metals, and we have it on the authority of one of our distinguished Past Presidents, Sir Robert Hadfield, that the world's loss by corrosion of iron and steel represents many million of tons per annum.

In this address I intend to confine my remarks to the floating holder, for while it may be said, with a degree of truth, that the guide framing of the gasholder is usually designed with some generosity, this does not apply to the sheeting of the holder, which is the thinnest material used in the whole structure and is subject to both external and internal deterioration.

The life of a gasholder is a matter of considerable importance, not only from a financial point of view, but because of the anxiety and inconvenience caused by even a temporary loss of storage capacity. Therefore an obligation rests upon all makers of gas plant to provide the most durable material in the construction of such an important structure; and though we recognize that change and decay are among Nature's inexorable laws, yet the more we can reduce the expenditure on renewals and repairs, the more capital will there be available for the extension and enlargement of the gas plant generally.

The total cost incidental to replacement of defective parts is always considerably in excess of the new material required, and furthermore the reduction in sectional area which directly affects the strength of the holder, due to corrosion, is often productive of serious consequences.

CORROSION A COMPLEX REACTION.

All metals when exposed to atmospheric influence have a certain inherent tendency to revert to the form in which they were originally found in the earth. The formation of rust, when the clean metal is brought into contact with air and water, is an example of this action. Corrosion has often been looked upon as a simple reaction, the same everywhere and under all conditions. It is, however, complicated by varying factors. Different classes of metal structures appear to be affected in a somewhat varying degree. For a long time opinion was divided, and it was only a few years ago that accumulated evidence pointed clearly to the conclusion that external conditions generally control the rate of corrosion, rather than differences in composition which exist in the more widely used forms of iron and steel.

This corrosion affects the surface of a thin sheet to the same depth as the surface of a thick sheet, and therefore causes a definite reduction in thickness. In most cases the initial rate of corrosion is much greater than after a short period of time, though corrosion is rarely uniform over the entire surface.

If we consider a No. 10 B.G. sheet, which is equal to 0·125 in. thick, and a sheet of 12 B.G., which is 0·0991 in. thick, each being reduced in thickness by $\frac{1}{16}$ in. over a certain period of time, it will be seen that, while the 10 B.G. sheet has had its thickness reduced by 50 p.ct., the 12 B.G. sheet has suffered a reduction of 63 p.ct. of its original thickness. Taking these facts into consideration, it would appear to be an economical proposition to make a liberal addition to the thickness of the gasholder sheeting in the original design, to allow for the effects of corrosion.

Special attention should be given to the thickness of the gasholder sheeting, and care taken to see that the rolling mills supply the exact gauge of sheets specified. It is the usual custom for the rolling mills to supply sheets to a specified weight per square foot, with a margin of 2½ p.ct. over or under. This arrangement is not satisfactory for sheets intended to be used in constructing the floating holder, as (owing to the springing of the rolls) sheets supplied on a weight per square foot of area basis are apt to be of a greater thickness at the centre of the sheet than on the edge; and as the maximum corrosion is usually found to occur at the riveted lap, it will readily be seen that the extra thickness of material at the centre of the sheet is of no advantage.

STRENGTH OF A CHAIN EQUAL TO WEAKEST LINK.

In the early days of the gasholder, the sheets were of comparatively small dimensions—about 4 ft. long by 2 ft. wide—but with the advent of large sheets, of nearly three times that area, the makers find that it is impossible to provide (say) a No. 10 B.G. sheet of an average weight of 5 lbs. per sq. ft., which will give a thickness of $\frac{1}{8}$ in. on the edge. It therefore follows that this springing of the rolls produces a sheet which is substantially thicker at the centre than on the edge, and as the strength of a chain is only equal to its weakest link, so is the value of the sheet only equal to its thinnest part. This point is particularly important in the case of the crown sheeting, where the strain is very much greater than in the side sheeting of the holder; and therefore the rolling mills' conditions do not adequately meet the needs of our requirements in the gas industry. It is useless to have a mass of material in the body of the sheet, with the thickness of the edges materially below the gauge specified and intended.

It has always been my practice when ordering sheets to ignore the theoretical weight of material per square foot, and to insist upon the sheet being rolled fully up to the specified gauge on the longitudinal edge, irrespective of the weight per square foot; and all sheets which did not conform to this stipulation were rejected. Of course it is impossible for the mills to provide this thickness on the longitudinal edge without claiming an increase in the rolling margin, but most of the steel makers of repute are able to meet our requirements if an allowance of 10 p.ct. in excess of the theoretical weight per square foot is allowed by the purchaser. This is reasonable, and should be accepted by the buyer. The increase in weight of the sheeting necessarily involves an addition to the cost of the holder; and this suggestion is often rejected on the ground of first cost. Economy is entirely admirable; but the engineer who is always keen on obtaining the cheapest gasholder offered generally gets what he seeks, and then pays the difference in the long-run, especially where the holder has been designed with the lowest possible margin of safety, in extremely competitive cases. I suggest that the following clause should be inserted in all specifications for gasholder sheeting.

> All the sheets used in the construction of this holder must be of British manufacture, and up to the required thickness specified on the longitudinal edges; they will be gauged by means of a Brown & Sharpe direct reading micrometer caliper at three places on each longitudinal edge—viz., in the centre and at 2 in. from each end of the sheet. Sheets which gauge more than 2½ p.ct. under thickness at any one of these places will be rejected. It must be clearly understood that the weight of the sheet will not be accepted as proof of thickness.

Direct Reading Micrometer Caliper.

A word might, with advantage, be said with regard to patent flattening, which is generally known as "stretching" the sheet. I do not think that sheets for gasholder work should be subjected to this treatment, as they have to be stretched to about their elastic limit to flatten, and often (when buckled) very much above this limit, effectively to take out the buckle; and it will readily be admitted that, with the heavy strain which gasholder sheets have to undergo when subjected to this method of flattening, they are rendered unsuitable for holder work, as it may set up incipient and minute cracks, thus reducing the strength of the sheet and its power of resistance to corrosion. For these reasons, the sheets should always be flattened by mangling, rolling, or manual sheet levellers.

EFFECT OF TEMPERATURE.

When metal is undergoing atmospheric corrosion, the damage is often worse on the side exposed to the direct rays of the sun, due to the fact that the moisture deposited on this side is evaporated rapidly by the heat of the sun's rays. Con-

densed moisture readily takes up salt mist from the ocean, which accounts for the reduced life of holder sheeting at gas-works in coastal towns.

It is interesting to note that Mr. Andrew Wilson, M.Inst.C.E., General Manager of the Australian Gas Light Company, Sydney, New South Wales, on making an internal examination of one of his three-lift holders, confirmed our English experience, and found that corrosion was very much more pronounced on the highest temperature section. The sheets of the inner lift were found to be reduced to practically half the original thickness; those of the middle lift showed less signs of internal corrosion, whereas those of the outer lift were practically as good as new. Deposits of salt and rust were found at the horizontal joints on the ledges formed by the laps of the sheets. The leaks in the crown of this holder mostly occurred in the middle third of the distance between the centre and the curb, and those in the side sheeting were, roughly, in the middle third of the distance between the curb and the cup.

Mr. H. Tindale, President of the New South Wales and Queensland Gas Institute in 1921, dealt with this subject in his masterly address, and stated that "it was evident that corrosion in this gasholder was due to at least two factors—viz., temperature of the iron and the influence of electrolytes. Temperature increases the affinity of oxygen and water—present as vapour in the gas—for iron. In addition, the rise of temperature causes unequal heating, particularly in a large mass like a holder; electrical activity is then set up between the warm and cool parts, resulting in increased corrosion at the warmer point. The electrolytes are present in the form of ammonium salts in solution in water, and their effect on corrosion is very pronounced at increased temperatures, thus accounting for the difference between the warm and cool side of the holder."

In a gasholder which my firm recently constructed for the Australian Gas Light Company, a distinct departure from usual practice was made at the request of Mr. Andrew Wilson, M.Inst.C.E., the General Manager of the Company, by constructing the side sheets of the holder with the riveted lap reversed—as in fig. 1—in order to prevent the deposit of any salts or rust on the edge of the sheets on the inside of the gasholder. By following this method of construction with the ledge of the sheeting on the outside, it allows any moisture to remain there until evaporation takes place. The usual method of construction is shown in fig. 2.

By reversing the lap, the edges of the sheets are readily available for inspection and painting from the outside, and it would therefore appear that this is a modification in detail which should receive very careful consideration from gasholder designers.

Need for Careful Investigation.

I would recommend those who are responsible for the safety of a gasholder to make a close and careful investigation of actual conditions on the first signs of corrosion in the crown sheeting. I am convinced that most of the disasters which have occurred to holders have been caused by the bursting of the crown sheeting, thereby allowing the inner lift to drop into the tank, and in its descent probably causing some damage to the other lifts and guide framing. Whenever the crown sheeting is badly corroded, the holder should be put out of action and the sheeting renewed.

When the strain on the crown sheeting is seriously considered, it should be unnecessary to utter a word of warning against the not uncommon practice, which many of you must have met, where repairs have been effected by inexperienced jobbing engineers, on the crown of a gasholder, in such a manner that the patch of new sheeting applied serves only to cover up the hole and so prevent any further leakage of gas, without in any way restoring the original strength of the sheeting, and in many cases has actually reduced the strength of the crown to an appreciable extent.

What is the Best Material for Floating Holders?

The question naturally arises, What is the most durable material to use in the construction of the floating holder, and which is the cheapest in the long-run? At the present time there is a rather extensive choice of materials—viz., wrought iron, Bessemer steel, Siemens-Martin steel, "Armco," copper steel, and, in addition, a countless number of rustless steels of various makes. As the initial cost of these latter brands is prohibitive they need not be considered at the present time; but we might all express a pious hope that improved methods of production and rapid progress in the science of metallurgy may eventually enable makers of such steels to market them at a price considerably below that ruling at the present time. None of these special methods, however, is entirely resistant to corrosion for more than a certain period, or under a limited set of conditions; and up to the present time much more should be done in controlling the ravages of corrosion by the use of improved protective coating.

Attention is often directed to examples of ancient wrought iron which have shown exceptional durability over a long period of time. The well-known Delhi pillar, which was forged over fifteen centuries ago, is invariably cited as one of the most outstanding of these cases. The iron of which this famous pillar is composed has been analyzed, but this chemical investigation has not in any way accounted for its long life, as it was found that the constituents of which the iron is composed varied very slightly from an ordinary example of modern charcoal iron, with the exception that the carbon content was somewhat higher. Competent authorities are inclined to attribute this particular case of extraordinary durability to the dry climatic conditions, rather than to any inherent characteristic of the metal itself.

With respect to wrought iron and steel in general, there appears—according to some engineers and scientists—to be a great amount of evidence which points unmistakably to the conclusion that there is no inherent difference between these materials with regard to durability; and apparently the balance of evidence is now only slightly in favour of wrought iron. The influence of surface finish is more marked than that of composition, but, as a rule, external factors predominate over all. Nobody doubts that badly made steel may misbehave, but

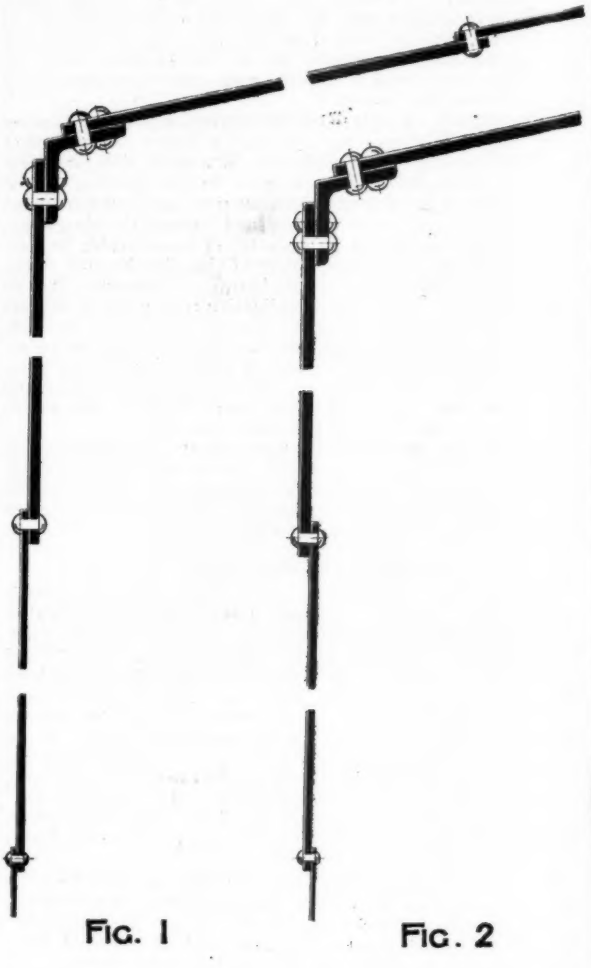


Fig. 1 Fig. 2

the distrust of steel may be nothing but a survival from a day when it was justified.

"Flyers."

In large towns and industrial districts, notably in South Wales, the atmosphere carries a considerable amount of solid matter, generally known as "flyers," some of which is deposited on the crown and in the cups of the gasholder. This deposit will accelerate and localize corrosion by the contact effect of dissimilar material and the retention of moisture for a longer period on the gasholder sheeting. This increased severity of modern corrosion conditions around our thickly populated centres is a factor which renders it difficult to compare the older and modern metals. In some cases the long endurance of some old wrought iron has been shown to be due to the presence of protective coatings, natural or artificial. In many cases there was probably some reason for the belief that wrought iron was better than steel. The rough surface of the old wrought iron favoured the adherence of protective coatings, and may have accounted for the better service given by wrought iron in certain cases under atmospheric conditions.

The quality of the metal and the chemical analysis and percentage of impurities all need close investigation, as some

of these are often supposed to assist the metal in resisting corrosion, while others are stated to hasten decay. I well remember that, at one time, copper was considered a deleterious impurity, and most of the rolling mills would aver that their steel contained only a "trace," whereas at the present time one of the rust resisting steels on the market derives all its claimed virtue from the inclusion of an increase in the percentage of copper it contains.

WROUGHT IRON.

Wrought iron is generally considered to be more durable than ordinary mild steel, but it is a metal which can only be manufactured by the slow process of puddling. The inventions of Bessemer, Siemens, Martin, and others practically submerged the wrought-iron industry; consequently there are very few mills properly equipped for its production at the present time, either at home or abroad.

There are many gasholders in existence which have been made from iron sheets, from genuine puddled iron, in the old-fashioned way, which tends to prove that sheets made from a good quality of puddled iron with a low sulphur content have withstood the ravages of time and weather. The gasholder attributed to Murdoch, erected in a brick tank at the works of Messrs. Boulton & Watt, Soho, Birmingham, now in the occupation of Messrs. Avery, Ltd., is an interesting example of the longevity of thin gasholder sheeting. This holder is 36 ft. in diameter by 19 ft. deep, and was erected in the year 1798. The existing records show that it was used for the storage of coal gas from the date of its erection until about the year 1896. After this date it was used for storing producer gas, which caused its rapid destruction. An analysis of the iron used in the construction of this holder gave the following results: Carbon 0·04, silicon 0·28, sulphur 0·045, phosphorus 0·550, manganese 0·07, copper 0·02, and iron 98·9.

The total impurities in the iron amounted to 0·99 p.ct., and therefore it could not be described as "pure iron."

It must be borne in mind that the success of the old process of puddling depends to a large degree upon the individual skill of the operator. The human element enters to a great extent into the manufacture of wrought iron; and as so much depends upon the experience and training of the puddler for its success, it is questionable whether workmen of sufficient experience are now available for the production of the class of material made in the old-fashioned way which was used in the construction of the early gasholders.

Specimen analyses of present-day wrought iron sheets of high-class Staffordshire quality give the following results:

—	Sample 1.	Sample 2.	Sample 3.
	P.Ct.	P.Ct.	P.Ct.
Total carbon	0·03	0·035	0·035
Silicon	0·100	0·100	0·100
Manganese	0·05	0·05	0·06
Sulphur	0·014	0·014	0·014
Phosphorus	0·247	0·235	0·262

These analyses can only be taken as representative of the actual sheets analyzed, and are bound to vary somewhat from the fact that wrought iron is produced in small quantities per charge, and the process of manufacture to which I have previously referred. Such variations are, however, comparatively slight, and are probably not sufficiently pronounced to affect the general characteristics of the sheet.

Whenever wrought-iron sheets are specified, great care should be taken to see that the material is equal to the product which was supplied in the 'eighties, and that it is of British manufacture, for it is well known that much of the Continental, and even some of the lower grades of English so-called wrought iron, contain a large percentage of steel. Such material might easily be accepted for genuine wrought iron, as it apparently has a fibrous fracture; but when examined closely, it is found to be made up of layers of steel. There are, however, a few English firms who are justly proud of their reputation, and will guarantee that their iron is free from steel. It might be as well to mention that it is unreasonable to expect the same smooth surface in a wrought iron sheet which is obtainable in the case of steel, and the wrought iron sheet is, therefore, often condemned without sufficient reason, or with any hope of replacing it with sheets having a better surface.

STEEL.

Much of the engineering development of modern times has been due, either directly or indirectly, to good sound British steel, and the advance made in the manufacture of steel in the last thirty years has considerably improved the quality of the material produced in England.

The Bessemer, Thomas, and Siemens processes are characterized by the fact that very large quantities of pig iron are treated in one operation, and the cost of production is, therefore, considerably reduced. As these steels are less costly than wrought iron, together with the fact that the tensile strength of their products is much higher than those of the puddling furnace, they have put puddled iron, for general engineering purposes, out of court. These conditions largely obtain at the present time. As instancing the disparity in cost only of wrought iron and steel, the price of wrought-iron sheets No. 10 B.G. "Treble Best" is £19 per ton, whereas the price for steel sheets is £10 3s. 9d. per ton. These figures are useful in showing that users could not contemplate buying wrought iron when cost and mechanical qualities alone are involved. It is this disparity in cost and increased general strength which has completely overshadowed the production of wrought iron, and has led, in the majority of iron works, to the scrapping of all plant used for its production; and unless some development in the mechanical method of wrought iron making is soon forthcoming, nothing will save the wrought-iron trade from complete extinction.

I would strongly urge all gas engineers not to accept Bessemer steel, owing to its disconcerting variation in quality; and it is a satisfaction to know that practically none is now made in this country. Continental material, certified to have been tested and to have passed the British Standard Specification, which requires 28 to 32 tons tensile with 20 p.ct. extension, when re-tested in this country was found to vary considerably. Some specimens gave a tensile strength as low as 24½ tons, with an extension as low as 15 p.ct. Gas engineers should realize that the steel for constructional purposes obtained from Continental mills is practically all Bessemer, and differs very materially from that made in this country.

I may say that it has been my practice resolutely to refuse to accept Bessemer steel, wherever made. Not only is it uncertain in quality, but its nature appears to vary considerably. I have seen samples which appeared to be soft and ductile, and other samples from the same rolling as brittle as glass; and, in my experience, it is less able to resist corrosion. British Siemens-Martin steel can be depended upon to give consistent results throughout.

Many engineers contend that their experience shows little or no advantage in respect of relative corrosions between steel and wrought iron, and it would appear that more lasting results are obtained by using steel sheets, and adding an extra gauge to the thickness, thereby ensuring the life of the steel sheet to be equal to that of wrought iron, at a very much less initial cost.

"ARMCO" IRON.

"Armco" ingot iron was put on the market for the first time about twenty years ago, after considerable investigation and research, prompted by the fact that the presence of greater quantities of manganese and other metalloids in mild steel was considered by some scientists to be the main cause of rust. As "Armco" possesses great purity, it is contended by the makers to be more lasting than either steel or wrought iron. Armco is 99·84 p.ct. pure iron. A typical analysis is: Silico 0·005, sulphur 0·035, phosphorus 0·005, carbon 0·015, manganese 0·020, copper 0·040, oxygen 0·035, hydrogen 0·001, nitrogen 0·004, and iron 99·84 p.ct.

"Armco" has about the same tensile strength as Swedish charcoal iron, or the best brands of wrought iron.

The physical constants of "Armco" iron are as follows:

Tensile strength	17 to 22 tons	
Elastic limit	8·5 ,, 11 ,,	
Elongation on 8 in.	22 p.ct.	not less
Reduction of area	60 ,,	than.

These figures will vary to some extent, dependent upon the thickness of bar or plate and the working temperature. The cost per ton is about double the price of mild steel.

COPPER STEEL.

The comprehensive tests carried out by the American Society for Testing Materials have shown that the presence of copper is of primary importance with regard to the durability of steel under actual service conditions. The results of this research proved a very decided superiority for open-hearth steel containing copper in amounts of 0·15 to 0·30 p.ct., when exposed to wet and dry weather conditions, over similar steel without the copper content, and indicated that the life of such material is more than doubled by the introduction of copper. The marked influence of even 0·10 p.ct. of copper has been proved under severe atmospheric corrosion.

Subsequent investigation has confirmed the fact that steel with 0·03 p.ct. of copper corrodes only 60 to 70 p.ct. as fast as the same steel with 0·01 p.ct. of copper, and recommends 0·15 p.ct. as the minimum content from a corrosion standpoint. The adherent dense hard rust which forms on copper steel when exposed to the atmosphere forms an efficient protector to the underlying metal and assists in reducing the rate of corrosion, thus forming an increased resistance peculiar to copper steel. Furthermore, experience has shown that paint is more adherent to copper steel than to ordinary mild steel exposed to weather conditions. It may not be possible at present to give a satisfactory explanation of the reason for the influence of the copper on steel, but there appears to be no doubt that the advantages of copper steel have been conclusively demonstrated under atmospheric conditions.

In view of the above observations on copper steel, it may be

noted that there has been increased activity in Great Britain during the last few years with regard to this grade of material, and it is interesting to be able to state that the Earl of Dudley's Round Oak Works, Ltd., for several years past have very closely considered the manufacture of a rust-resisting steel which could be produced at a reasonable advance in price over the cost of ordinary mild steel; and, as the result of their research work, they have placed upon the market a special copper steel which is now well known under the brand of "Edrow" rust resisting steel, the cost of which is only about 30 p.ct. above that of ordinary mild steel.

Comparative corrosion tests recently made at the Earl of Dudley's Round Oak Works gave the following results. Carefully weighted test pieces of "Edrow" rust-resisting steel, mild steel, and best Swedish iron were suspended for 52 hours in a prepared bath containing a 1 p.ct. solution of sulphuric acid in distilled water.

Analysis of Test Pieces.

—	"Edrow" Steel.	Mild Steel.	Swedish Iron.
Sulphur	0·035	0·03	0·011
Phosphorus	0·02	0·025	0·041
Manganese	0·69	0·60	Trace
Copper	0·275	..	..
Carbon	0·185	0·16	0·05
Silicon	0·05	0·04	0·018

—	Initial Weight of Test Pieces (Grammes).	Loss in Weight After Test (Grammes).	Percentage Loss in Weight.	Ratio of Loss in Weight.
"Edrow" R.R.S.	16·744	0·0658	0·392	1·0
Best Swedish iron	16·800	0·0918	0·5464	1·39
Ordinary mild steel	16·8186	0·2096	1·246	3·2

Physical tests were carried out at the same time on "Edrow" rust-resisting steel, and gave the following results:

Elastic Limit in Tons per Sq. In.	Maximum Strain in Tons per Sq. In.	Elongation P.Ct. on 8 In.	Percentage Contraction of Area.
16·2	29·2	26	55·2

The "Edrow" rust-resisting steel welded perfectly and gave excellent results when submitted to severe bend and drift tests.

PROTECTIVE MEASURES.

As the corrosion of metals varies greatly with the surrounding conditions and the nature of the atmosphere, and as there is no general panacea for these troubles, the protective means which are used must be so designed as to meet these particular conditions. The only means of prevention found so far is the application of protective coatings, which require periodic renewal. The object of such coatings is to keep the corroding medium from contact with the metal surface; and therefore the development and use of a suitable protective paint is of especial importance in the preservation of the sheeting of a gasholder. Paints and other protective materials, though so numerous, are apt to receive but minor consideration with regard to the protection they afford to iron and steel from corrosion. The extent of protection afforded to the gasholder sheeting is dependent upon the suitability and quality of the coverings applied to them; and the proper preparation of the surface of the sheeting prior to the coating of paint being applied is of scarcely less importance than the character of the paint itself. A well-painted surface should last from three to six years according to the local conditions or circumstances. It is false economy to use inferior paints which are deficient in lasting properties, for the cost of application is from four to five times the cost of the paint itself.

An efficient paint must be impervious to moisture, and its ingredients must be neutral or opposed to corrosive influences, and should be sufficiently elastic to be unaffected by the expansion and contraction of the gasholder sheeting. The spreading or covering quality of the paint should not be too high, as in such cases the paint is applied so thinly that it cannot possibly offer the necessary resistance to corrosive atmospheric influences.

The surface of the sheeting should be clean, and freed from all loose scale, rust, grease, or oil by scraping and wire brushing. This treatment gives a surface to which the paint more readily adheres. Paint should be applied to a dry surface in dry weather when the temperature is about 70° Fahr., for under other conditions a film of moisture may exist on the sheeting which will not only tend to cause corrosion underneath the paint, but will also prevent the paint adhering to the sheeting. The priming coat should be sufficiently thin to fill and completely wet and cover any depressions in the sheeting. A thick priming coat may very easily bridge over such depressions, and thereby leave these parts of the surface less protected. Sufficient time should be allowed for perfect drying between successive coats.

It is not advisable to accelerate the drying of paints by the addition of an excessive amount of driers, as this has been shown to shorten the durability of the paint. Red lead, which has a high protective value, is generally accepted to be the best medium for the primary coat; but the old method of mixing by hand from the dry red lead, in addition to being extremely wasteful—owing to the rapidity with which it sets in the package—is now prohibited by the Lead Paint Act, 1926, and paste or liquid paint must now be used. It is well known that one of the most valuable properties of red lead is its ability to set to a hard elastic film which shuts out moisture and gases that are likely to initiate corrosion. A point of great importance in the selection of red lead is fineness of subdivision. This property has a very marked effect upon the appearance of the film and its protective properties. Red leads that are very coarse and granular may, when applied, show sagging, streaking, and running, leaving little channels of oil as points of attachment for the action of the elements; whereas finely divided red lead will not show running or streaking. The primary coat should be followed by the application of a second and following coats of paint which are designed to exclude and shed moisture, and so protect the primary coat.

I am fully conscious that some of you may contend that there is nothing to equal an oxide of iron paint. In cases where this class of paint is preferred, great care should be taken to procure an oxide of iron of sufficient degree of purity, and at the same time possessing the necessary preservative properties. The majority of the cheap oxide paints contain a very small proportion of oxide of iron and a large amount of adulterants, and are, therefore, of very little use as a protective covering against corrosion.

Even painting is not always effective in checking corrosion, but the wasting-away of material is bound to be more pronounced on those parts of the holder which cannot be systematically painted so as to afford protection to the metal in the future. The whole question of the best paint for protecting metal against corrosion is in itself a subject for the earnest attention of research work, and demands a thorough and painstaking investigation into the merits of the various coverings obtainable and in use.

OIL FILM.

The simple plan of placing a film of oil on the surface of the water in the gasholder tank, so that the side sheeting becomes automatically coated as the gasholder rises and falls, is reputed to give excellent results if certain details receive due consideration.

The firm of Messrs. Alexander Duckham & Co., Ltd., have made a study of this means of preventing corrosion, and have placed on the market a special oil of suitable quality, care being taken to select an oil which is not readily oxidizable, preserves its colour, does not emulsify, and is least disfiguring to the appearance of the holder. The quantity used must provide a film at least ¼ in. thick upon the water in the tank, and must be increased if a multi-lift holder is to be "filmed" with oil from the narrow external water space. The drifting of the oil from one side of the tank to the other under the

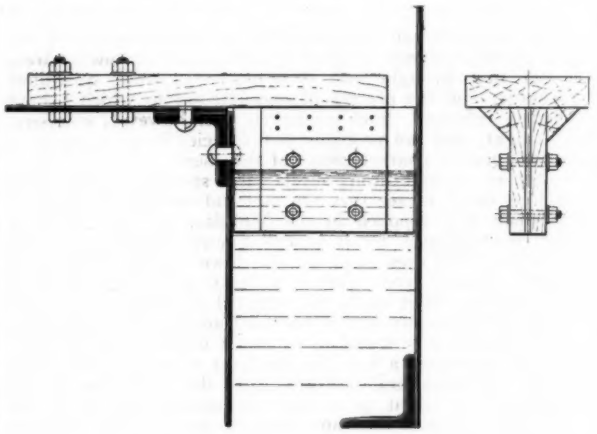


FIG. 3

action of the wind must be prevented by cross battens faced with felt against the holder side sheets; and I am indebted to Mr. E. F. Keable, the Engineer and Manager of the Gorleston and Southtown Gas Company, who has done a considerable amount of pioneer work and has solved many of the problems in connection with oil filming, for the detailed illustration of cross battens adopted at his works.

In cases where the cups of the upper lifts do not automatically pick up oil on rising, they must be separately oiled, and

provision must be made, by syphons or similar apparatus, for discharging rain-water, which would otherwise tend to displace the oil.

Experience has brought to light a number of incidental advantages accruing from the use of oil films. A film of oil on the water inside gasholders not only preserves the interior in a way which cannot be equalled by any other method, but prevents the gas absorbing moisture from the water in the tank, though not from depositing it. Hence the average amount of water passed into the distribution system is lessened. With the protection against ingress of moisture which filming affords, it is possible to ensure dry gas being delivered into the mains without the use of a tankless or waterless gasholder. Furthermore, an oil film is a good heat insulator and will prevent, or at least delay, the freezing of water in the tank.

To an ever-increasing extent the resources of science are being brought to the aid of industry, and more and more it is being realized that the world loses annually vast quantities of raw material through lack of knowledge of how to protect it from the ravages of time; and I venture to think that such an important matter as the life of gasholder sheeting should not be left to individual resources, where there is no cohesion or co-operation between investigating efforts. It is impossible to imagine anyone doubting the ample scope that exists for useful service in the establishment of properly organized research work. The problem calls for collaboration, since its needs are not adequately met by periodic conferences, at which selective views, frequently restrained or prompted by trade considerations, are given in a more or less generalized statement; and this address will have achieved its purpose if it contains sufficient to initiate a free and open discussion, which I hope will be helpful, and assist in focussing the attention of all those connected with the gas industry upon the vital importance of the subject which I have attempted to place before you.

Discussion.

Prof. ARTHUR SMITHELLS (who had taken the chair upon the President having to leave the meeting) said they had had brought before them an extremely interesting subject, and he would be both surprised and disappointed if the address did not produce a lively discussion.

GROWTH OF SCIENTIFIC INTEREST.

Major RICHARD MILES (Messrs. Newton Chambers & Co., Ltd.) was prevented from attending the meeting, but he sent the following remarks upon the address, which were read by Mr. MILES: Nobody is more qualified than my friend Mr. Milbourne to speak on a subject connected with gasholders; and it may be understood that his comments, criticisms, and constructive suggestions are made with the authority of one whose lifetime has been spent investigating the problems connected with gas-works plant that require iron and steel work in their construction. The manufacturer to-day takes a more scientific interest than formerly in the uses of his products, realizing that the most profitable way of continuing to supply his products to the consumer is to do so with intelligence, so that he can give better service. Unfortunately, it frequently happens that such service, based on intelligent experience, is more than discounted by a fraction of 1 p.ct. increase in prime cost; and still more unfortunately, nowhere is this tendency more apparent than with gasholders, the value of which is variously estimated at about a quarter of the cost of the whole gas-works.

That members of this Society are in a very favourable position to co-operate in research on corrosion, as suggested by Mr. Milbourne at the beginning and at the end of his paper, nobody can deny. I would heartily support such activity. But it would first be necessary to ascertain fully what has been done to date on the subject, and to find out what is being done. It may interest the members to know that in this country alone the following bodies are actively engaged in research on corrosion: The Department of Scientific and Industrial Research (one Committee for investigating the fundamental nature of corrosion and its measurement, and another Committee for investigating atmospheric corrosion), the Institute of Metals, the Iron and Steel Institute (jointly with the National Federation of Iron and Steel Manufacturers), the Institution of Civil Engineers, the Cast-Iron Research Association (Committee on Corrosion Resisting Irons), and the Faraday Society. In America, France, and Germany, also, extensive work is being carried out. Particular mention should be made of the Carnegie Institute and the Institute of Mining and Metallurgical Engineers in America, and the Bureau for Testing Materials in Germany. In Germany is published one of the best periodicals upon corrosion—"Korrosion und Metallschutz."

CAUSES OF CORROSION.

As you are aware, the actual causes of corrosion are not yet properly understood, but of the three theories—the electrolytic, the chemical, and the bacteriological—the electrolytic appeals to me as showing the most promise. The present time is not opportune for discussing these theories, but among the various causes it has been established that the following play an important part in accelerating corrosion: Atmospheric conditions; deposits of foreign bodies; contact with other metals; stray electric currents; unhomogeneous composition; internal stresses; and faulty design.

Some of these points have been dealt with by Mr. Milbourne; others are outside the control of the manufacturer, or if not outside his control, cannot be allowed for in his specification on account of expense. I would, however, emphasize the question of design. It is proved that stressed iron and steel is much more subject to corrosion than unstressed; and as the bell of a gasholder—particularly the crown—corrodes (say) through atmospheric influences in the first place, once it reaches a certain thinness due to atmospheric corrosion a condition of strain is reached, and the corrosion continues at a much more rapid rate. No amount of patching and painting will stop it. It should behove, therefore, every gas engineer to make calculations based on local conditions of wastage and ensuing strain of materials, and to specify the thickest crown sheets such calculations would justify. It also follows that, as the corrosion of strained material is comparatively rapid, corroded crown sheets should be renewed at the very earliest opportunity. Recent serious accidents would appear to bear this out.

On the question of actual material, I have a vast amount of evidence which appears to show advantages of copper steel as regards corrosion under atmospheric conditions, though owing to the time at disposal I do not propose to enumerate them now. Further, I may say that I should not be surprised if there appears shortly a new metal—an "artificial" wrought iron—which has the physical and chemical properties of the best old-fashioned puddled iron, and may be sold at a favourable price for structural purposes.

ASCERTAINING RELATIVE RATES OF CORROSION.

It may also be of interest to note that there are certain quick methods of ascertaining relative rates of corrosion: Alternately wetting and drying the given surface; increasing the temperature and concentration of the corroding media; applying an external galvanic action; the spray test; &c. But in case any of you wish to try these at your own works, I would warn you not to expect accurate correlation between the results you get, or between these results and those under actual practice.

Take an actual instance of an experiment carried out at our works upon 68 discs of four common structural materials—viz., mild steel, "Armco," copper steel, and wrought iron. The discs were hung in bottles insulated by small rubber washers, and subjected to the action of air, which bubbled through water at the bottom of the bottle for eight hours, and alternately for eight hours purified coke oven gas similar in all respects to town gas. At the end of two months all the discs were severely corroded, and to the eye the corrosion appeared the same. The discs were very carefully cleaned and weighed, and the following table shows the losses in centigrams per square c.m. It appears, therefore, after applying the equation of the probability curve, that there is very little difference in the resistance to corrosion by mild steel, copper steel, wrought iron, and "Armco;" but, as stated before, these figures can only be considered applicable to the precise conditions under which they operate:

Mild Steel.	"Armco."	Copper Steel.	Wrought Iron.
0·953	1·60	1·03	1·04
0·401	1·01	1·02	1·44
0·196	1·97	3·07	1·98
2·15	2·73	2·34	1·65
1·92	2·62	2·74	2·08
2·22	2·08	2·44	2·64
1·72	1·31	1·71	1·54
0·54	1·06	1·05	1·26
2·00	2·56	2·42	1·55
2·18	2·62	2·25	2·28
1·85	2·54	2·56	2·62
1·52	2·07	2·03	1·68
0·84	1·94	1·50	1·80
1·34	2·67	2·35	2·37
2·47	2·58	5·50	2·62
2·62	2·22	1·86	2·09
1·57	2·87	1·20	0·58

RETARDING CORROSION.

Finally, of the various methods employed for retarding corrosion—painting, galvanizing, barffing, sheradizing, electrolytic coating, metal spraying, counter flow galvanic action (as on certain machinery aboard ships)—the most obvious and practical methods applied to gasholder work, until more complete information is established, are:

(1) Use as thick sheets as practicable.

(2) See that they are in no condition of strain—*i.e.*, beyond their elastic limits.

(3) See that the mill-bloom is off. Clean the sheets well, and apply good and suitable paint.

(4) Have them professionally inspected at regular intervals not exceeding two years.

(5) Keep them well painted, but clean thoroughly and adequately before re-painting.

In the meantime, those in charge of these plants should continue to carry out such scientific experimental work as seems desirable to them, remembering that co-operation is the key-note of to-day's scientific and industrial activities; and I may add that I am convinced that the members of this Society, who are, I am well aware, doing a vast amount of research work in many directions, will not hesitate to make known, as the opportunity arises, the result of their endeavours to further the industry they serve.

Mr. SAMUEL CUTLER said that, in proposing a hearty vote of thanks to Mr. Milbourne for his address, he hoped he might at the same time be allowed to offer one or two friendly criticisms. When considered in relation to the many interests which the Society represented, he was constrained to say that he thought the address was a little confined. It must be remembered that the "S.B.G.I." was in no sense an exclusive technical or engineering institution. It was true that the members were all specialists, and best versed in their own particular line of business; but he did suggest for future meetings that the Chairman's address should be sufficiently wide in scope to be of more general interest, and not be too much concerned

with details—such, for instance, as the gauging of gasholder sheets and minor points of gasholder manufacture. On the other hand, if the address was intended to be a considered technical one, he thought the contribution was a most valuable addition to the literature on gasholder construction. ["Hear, hear."] He would discuss very briefly from this point of view one or two matters.

THE REVERSED LAP.

Did Mr. Milbourne give the weight of his undoubted experience in favour of the use of copper alloy sheets, at 30 p.ct. extra cost, on the result of a single 52-hour test by the makers, and did he definitely recommend the adoption of the reversed lap joint illustrated in the address, as used in a solitary instance in Australia? The painting of iron and steel structures was of much more general interest to the members; but might he ask the author how he proposed to put into practical application his recommended formula, wherein he stipulated as follows: "Paint should be applied to a dry surface in dry weather when the temperature is about 70° Fahr.?" This was no doubt ideal; but he hoped gas engineers were not going to adopt the Chairman's complete formula, because if they did so gasholder painting would be a very lengthy and expensive process, in this country at least.

OXIDATION.

Now, coming to oxidation, he thought the reasons for the accelerated deterioration of gasholders during recent times must be sought in other directions than the composition of the constructional material. With this, he believed, the author agreed. The high-grade gas of former days was in itself a preservative, whereas the degrading processes now in use all introduced, in more or less degree, constituents which had a deleterious effect upon metals. Another contributing factor was, he suggested, in some cases the fouling of the water in gasholder tanks by oxide, which was too often revivified in positions where it was blown in rough weather against gasholders, and fell into the tanks, into which the holder sheets dipped almost daily. His firm had had in their own experience recently several cases in which this undoubtedly had been a principal cause. The whole matter was one for far-reaching research by both gas companies and gasholder makers; and in this connection he would venture to ask what the Committee which he understood was appointed by the Institution of Gas Engineers was doing, and what progress it had made in investigating this very important subject. He might just add, perhaps, that Mr. Haseldine, the Engineer of the Barnet Gas and Water Company, had adopted quite a good method to ascertain whether, and if so to what extent, internal corrosion had taken place in his gasholders. He had drilled out of his holder sheets and plates while in use a series of discs about 1⅛ in. in diameter. These gave an idea of the extent to which corrosion had occurred, especially internally. He had with him two samples. One from a holder 50 years old showed no corrosion whatever; while the other, which was from a holder that had been 15 years in use at another works, presented quite a different state of affairs. These samples indicated the varying conditions which obtained in regard to this matter. It was a most important problem, which should receive consideration without delay.

Mr. F. R. SMITH, referring to "Armco" iron, said the author gave an analysis, as well as the tensile strength and the price, but he did not state whether from his experience he found that it did last a good deal longer than ordinary mild steel.

Mr. C. A. GOODALL (Vice-Chairman) remarked that, though the subject of the address was a little outside his province, it was one which everyone in the iron and steel industry was more or less up against; and if the research work which was being undertaken should result in means being found of avoiding this corrosion, it would be greatly to the benefit of all concerned. The address was one which would in all probability give rise to many differences of opinion as to cause and effect. Painting, again, was a matter of general concern; and, as had been said, some of them probably did not give to this matter quite the attention which it deserved. Of course it was not always possible to have a nice dry day and satisfactory temperature for the job. He had thoroughly enjoyed the address, which was full of good points; and he had great pleasure in seconding the vote of thanks to Mr. Milbourne.

PAINT WELL AND OFTEN.

Mr. J. W. SCOTT (Messrs. R. & J. Dempster, Ltd.) said he had noticed that gasholders erected just prior to the war—for instance, in the years 1911, 1912, and 1913—had behaved very differently from others; and this had been entirely attributed to the matter of painting. During the war period it was very difficult to obtain paint; and gasholders were among those things which suffered more than others from neglect. Corrosion commenced; and with steel, once it began it was a very difficult matter to arrest. He felt sure that the investigation to which reference had already been made would reveal the fact that a good deal of corrosion had arisen owing to the neglect of holders during the war period.

Mr. F. H. LAMB remarked that his interest was in painting; and he thought that the main trouble as regards the corrosion of gasholders was with the engineers themselves, who did not paint often enough. Sometimes they did not recognize the importance of having the work properly done. In the first place, it was advisable that all sheets should be painted inside as well as outside. A suitable lead coating should first be applied, well rubbed in, and thoroughly dried. Then one had a foundation for the ordinary paint. Outside it was highly important to have good oil for the mixture. It did not matter so much about the pigment, so long as the oil had lasting properties. It must be well treated, and be able to withstand atmospheric influences. The work must be thoroughly well prepared before the painting was done; and they must paint often.

COMMITTEE OF THE INSTITUTION OF GAS ENGINEERS.

Mr. WALTER T. DUNN, alluding to the contribution to the discussion forwarded by Major Miles, said there was an omission from the list given of what he himself regarded as a rather important body who were also investigating this subject—that was, the Institution of Gas Engineers. It would be within the recollection of the members of the Society that, following upon the unfortunate accident at Manchester, the Institution of Gas Engineers had appointed a Committee called the Gasholder Construction and Deterioration Committee, to which their friend Mr. Cutler had referred. This Committee were at work; but things could not be done in a hurry, and he thought Mr. Cutler would be one of the first to admit that research work did require time. Mr. Doig Gibb had been appointed Chairman of the Committee, and some very eminent engineers were working upon it. It occurred to him that in all probability that Society would be asked to co-operate. He thought it might be taken for granted that good results would follow this investigation. All were agreed that research work was essential. Might he, as an engineer, and as the ex-Secretary of the Institution of Gas Engineers, be permitted to ask Mr. Milbourne whether he had given any special consideration to the question of the electric welding of gasholders? This principle had been utilized in connection with big holder erection in Australia. Another thing of which he might remind the members was the work being done by the Institution of Gas Engineers in collaboration with the Society on the production of genuine wrought iron for making tubes, &c. They could claim good results from this. Manufacturers of tubes were putting upon the market material which was far better than it used to be.

URGING A RETURN TO THE USE OF PUDDLED IRON.

Mr. COMLEY (Messrs. Alexander Comley, Ltd., Birmingham) said he would like to make a few remarks in favour of the practice of using puddled iron. It had been objected, and would be, that puddled iron was rejected mainly on account of its cost being prohibitive. Very likely that was the original reason; but he would like to appeal, first to gas engineers, and secondly to constructional engineers, to urge a return to the use of puddled iron, on broad national grounds, as well as on the grounds of its being a factor in the ultimate cheapening of their cost—according to the theory that, although the first cost might seem prohibitive, sufficient extra life would justify it. To whatever part of the world they might travel, they would find that Staffordshire in particular, and England in general, were known by the reputation established in the past in connection with the production of puddled iron. What claim had they as a nation in connection with the production of steel? Steel was a product of almost every country in the world. They would do a good deal to rehabilitate one of the oldest, and at one time most prosperous, of the industries, if they would turn their attention to the many purposes, including that of gasholder construction, for which puddled iron could be used. He must confess to considerable surprise at the statement made during the discussion, that there was practically no difference in the rate of corrosion between steel and puddled iron. In regard to this, he felt he must make a little mental reservation. They should by all means bring back, for the benefit of themselves and of the country as a whole, puddled iron to its former uses.

SCIENCE MUST GO HAND IN HAND WITH PRACTICE.

Prof. SMITHELLS said that both the address and the discussion had been most valuable. For his own part, he was intensely interested in the subject of corrosion. As a scientific problem, it had attracted him from very early days; and he at one time knew something about it. That had enabled him to note with satisfaction the growth of interest on the scientific side in this most important problem. There had been such a tremendous advance in knowledge of the subject during the last ten or fifteen years that there was now a body of information at hand which surpassed the capacity of even the most energetic man to survey. Some years ago he was in India, and saw the famous Delhi pillar, referred to by Mr. Milbourne, which was forged fifteen centuries ago. He brought back with him samples of iron as old; and he would be much surprised if, at the end of his own little investigation, he did not share the opinion expressed in the address, that the extraordinary durability of this wonderful monument of antiquity was due rather to climatic conditions than to any peculiarities in the nature of the iron itself. To him a particularly interesting portion of the address was the reference to the holder erected by Murdoch. The fact that it had survived for something like a century in the atmosphere of Birmingham was hardly less a wonder than was presented by the pillar at Delhi. What was the gauge? There was, of course, an immense amount of concerted investigation going on at the present time. This was most encouraging and most important; and he had no doubt steps would be taken to see that these different organizations were in correspondence with each other, and that each was aware of what the others were doing. Thus the portents were very hopeful, and they might look forward to getting further with a question which ought to have been advanced much more than it had during the preceding generation or two. There was not the slightest doubt that they were within sight now of a much better understanding of the fundamentals of the corrosion process. They were in a more promising position than ever they had been before with regard to getting at the real root of the matter. The auguries were excellent; but science would always have to go hand in hand with practice, and the differences between one set of circumstances and another would have to be fully recognized.

MR. MILBOURNE'S REPLY.

Mr. MILBOURNE, replying to the discussion, said he agreed to some extent with Mr. Cutler that the address was confined—probably due to the fact that this was the only platform on which they, as constructional engineers, could bring forward their theories and their difficulties, and it was important that they should do so whenever they were faced with a problem which was common to all of them. Their immediate Past-Chairman, at the commencement of his address a year ago, showed the very varied range of subjects which previous Chairmen had treated upon. Certainly he (Mr. Milbourne) had experienced, and he felt quite sure future Chairmen would experience,

much difficulty in finding some new topic which would be of interest to every member of the Society. He thought the only possible way of dealing with the matter was for each succeeding Chairman to take up a subject with which he was well acquainted, and which was immediately connected with his own business. ["Hear, hear."] This was the only excuse he could offer for having selected his own topic.

COPPER STEEL TESTS.

With regard to Mr. Cutler's query as to whether he had actually tested the copper ("Edrow") steel to which reference was made in the address, he might say that he had not put it into any gasholder which had been built, but he had had some practical comparative exposure tests made on three types of sheets, extending over a period of twelve months. They were small samples; and the results were as follows:

Results of First Twelve Months Ordinary Atmospheric Exposure Tests of Three Types of Sheets.

	P.Ct. Waste.
Ordinary mild steel sheets	13·4
Wrought-iron sheets	10·9
"Edrow" rust resisting (copper) steel sheets.	6·3

He did not, however, consider that even this was a conclusive test. It did seem to him—and his experience would tend to prove it—that every case case presented complications. One might carry out the tests in a different aspect, and get different results. Had Major Miles been present, he would have been able to furnish some further information regarding copper steel, as it had been used extensively in America; and a great amount of research work had been done there upon it. He himself, however, had not had the opportunity of increasing by even 30 p.ct. the price of any holders he had been making. [Laughter.]

REVERSING THE RIVETED LAP.

Another point raised by Mr. Cutler had reference to the adoption of the reversed lap joint in the special case described in the address. He (Mr. Milbourne) was certainly inclined to think that the idea was a good one, and that it would in time be more generally adopted. It seemd to him that much internal corrosion was due to modern conditions of carbonizing, in some form or another; and if the lap was on the inside, and there was deposit of rust, it was impossible to do anything until the holder had been thrown out of use and inspected. With the lap reversed, as shown in the illustration, moisture would lodge on the ledge, but it would be under immediate observation, and to that extent the arrangement was a distinct advantage. He quite recognized the difficulties in applying paint under the conditions he had set forth; but his statement was that it "should" be, not that it "must" be.

OXIDE PURIFIERS IN PROXIMITY TO GASHOLDERS.

Yet another point that had been raised by Mr. Cutler was with regard to the fouling of the water in gasholder tanks by oxide, when revivified in positions nearby. He (Mr. Milbourne) had noticed many cases in which gasholders had suffered excessive corrosion, due to the fact that they had been placed near purifiers, or where the prevailing wind had wafted fumes of oxide of iron on to the gasholder. There was one example in the Midlands where the holder was perfect in every part except just in front of a set of purifiers which was placed very near the holder. The contribution by Major Miles was a very helpful one. It was encouraging to have information with regard to Committees already appointed. It seemed to him that there was an enormous amount of research work on this particular subject being undertaken at the present time; but it was scattered, and there appeared to be no means of getting together, putting their difficulties forward, and securing really reliable data which they required. If it were possible to co-ordinate the efforts of all these different bodies, or exchange the results of researches, much good would be done in elucidating what might be termed the "mystery of corrosion."

"ARMCO" IRON.

With regard to various special materials to which reference had been made, it was, of course, really a matter of price. Some of the rustless steels, if he could afford them for gasholders, would give excellent results. As a matter of fact, he had constructed holders of "Armco," and so far as he knew, they were giving excellent service. It had been in use now for over twenty years; but it was time alone which would prove whether "Armco" or any other steel was better than genuine puddled Staffordshire iron. He believed "Armco" had been found unsatisfactory for the manufacture of meters. It was quite possible that one material might, under certain conditions, be better than others. He agreed with Mr. Scott that a great amount of damage was done during the war, owing to the fact that steel structures were neglected and were painted improperly. If paint was not properly applied, or was put on at the wrong time, it could not do any good, because corrosion would continue to take place. Of course they had noted in the Technical Press that a Committee had been set up to deal with the question of deterioration and design of gasholders. As members of this Society, they did not know to what extent the labours of the Committee were likely to go; but they would welcome any opportunity of co-operating with them.

ELECTRIC WELDING.

With regard to the question asked about electric welding, he might say he was not quite sure that it was successful. It had not been adopted to any great extent, except overseas; and from conversations he had had with some of their Colonial friends, he gathered that the system had disadvantages. It certainly was not as economical, and he should think that the localization of heat in the welding would have a deleterious effect upon the sheet. At present he would not feel justified in recommending it in place of riveting. He sympathized with Mr. Comley in his plea for the retention of Staffordshire wrought iron. Undoubtedly, there were reasons for thinking that it was the most durable of all the metals they had; but, as he had mentioned in his address, it was not only the question of cost that had put wrought iron out of court—it was also the question of tensile strength. The Murdoch holder was 14 gauge. He had inspected this holder before it was used for producer gas. It seemed perfect when employed for ordinary coal gas; but directly producer gas was put in, it deteriorated very rapidly. This clearly showed that it was the composition of the gas which affected internal corrosion. When it was opened out, he again had an opportunity of inspecting the holder; and the sheets were then very badly corroded.

NEILL PROCESS FOR MANUFACTURING RED OXIDE.

A British Invention.

At a recent meeting of the London Section of the Society of Chemical Industry, Mr. J. Arthur Reavell described a remarkable new process for the manufacture of red oxide of iron, possessing high-class pigment properties, from spent pickling liquors and similar materials. The process is the subject of a number of patents taken out by Mr. O. S. Neill, and owned by the Caer Chemical Company, of Llanelly.

A plant is in operation (having a capacity of 50 tons of red oxide) using spent liquor obtained from a tinplate works. The liquor is dehydrated, and a finely-divided powder of monohydrated ferrous sulphate is produced. The heat required for the evaporation of the water is obtained from the waste heat of the calcining furnaces; the latter being continuous. The powdered sulphate is converted by roasting, in the presence of air, to ferric oxide while still in the finely-divided condition. One of the great advantages of the process is the evenness of the roasting.

The first step in the manufacture of the oxide lies in reducing the free acid content of the spent liquor received. This is accomplished by filling the liquor storage tanks with scrap iron, and maintaining the temperature at 40° C., to facilitate the reaction and to prevent crystallization of the sulphate. From the settling tanks the liquor is pumped to a spray drying plant of a special type. The dry powder from this drier has a composition corresponding to mono-hydrated ferrous sulphate. It must be mentioned that the material comes from the driers in the form of hollow spheres—a fact which provides a ready means of control of colour as compared with solid spheres.

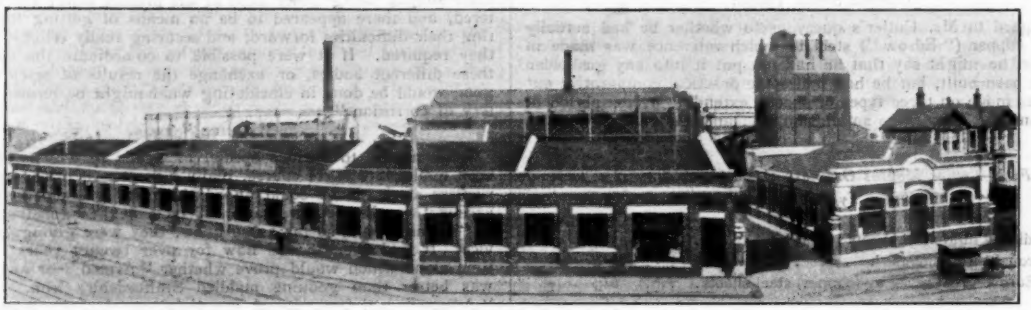
The calcination of the ferrous sulphate is carried out by means of a coke-fired rotary calciner; and it is possible to obtain complete conversion of the sulphate. Provided the calcination has been of sufficient duration, the chemical composition of the product is invariable, and corresponds to the formula Fe_2O_3. The colour of the oxide produced at different temperatures, however, varies considerably; and, in general, the lighter and more valuable shades are obtained by calcination at a low temperature, and the darker and purple shades by calcination at higher temperatures. The colour shade and pigment value of the finished products are not solely dependent on the conditions of calcination. The nature of the powder entering the calciner is of vital importance.

For many purposes the powder leaving the calcining plant is in its final condition; but when an oxide in an extremely fine state of division is required, and where special precautions have to be taken to render the oxide free from acid, a further operation has to be carried out. This depends on the disintegration of the oxide leaving the calciner when it is placed in hot water. Ordinary calcined copperas will not disintegrate in this way; and in order that the process shall work satisfactorily, it is necessary that the first stage of the dehydration—*i.e.*, the treatment in the spray drying plant—shall be carried out under particular conditions. After treatment with water, the oxide is re-dried, and a powder of extremely high covering power is produced. This powder will remain in suspension in water for several days. In oil the suspension is for an indefinite period.

Work is being undertaken to determine the efficiency as a catalyzing agent of the ferric oxide made in the calciner. From the composition of the gases leaving the latter it seems evident that an oxide of extremely high catalyzing power is being produced.

NEW PLANT AT DUNEDIN.

Installation of Glover-West Verticals.



An installation of Glover-West vertical retorts erected for the Corporation of the City of Dunedin, New Zealand, was officially inaugurated by the Mayor (Mr. W. B. Taverner) on Sept. 7. Mr. F. J. West, who was on a world tour, reached New Zealand in time for the ceremony.

The following account of the official inauguration of the new installation is extracted from the "Otago Daily Times."

The MAYOR briefly extended a welcome to those present, and, introducing Mr. West, called on him to hand over the plant.

Mr. WEST said he was delighted that his visit to Dunedin had coincided with the opening function. He hoped that the installation of the new plant would be followed by an era of prosperity for the Gas Department, and that the citizens would benefit by it. He was of opinion that in his own city of Manchester—and this would probably apply to Dunedin also—the citizens were not fully alive to the benefits of the gas, and were apt to think that the gas industry was a dying one; but he would point out that in every country where gas was used gas shares were still the gilt-edged securities of the market. Though people did not realize generally what an asset the gas industry was to any town, figures showed that the demand was increasing steadily. He hoped that the value of the new process would reflect itself in a reduction in the price of gas.

The MAYOR, in taking over the plant on behalf of the citizens and councillors, said that hand in hand with the increased demand for electricity had come a similar increase in the demand for gas. They had found the old plant expensive and inefficient; and, whereas it produced only 13,000 c.ft. of gas from a ton of coal, Mr. West's plant was now giving them 21,570 c.ft. per ton. Referring to Mr. West's remarks regarding gas shares still being the gilt-edged securities of the share market, Mr. Taverner said that the Gas Department had certainly been a gilt-edged investment for the city. In fact, it was the best investment, on a basis of expenditure, of anything that the city had ever owned; and thus the Dunedin Gas-Works were supplying the cheapest gas in New Zealand—a state of affairs which, he hoped, would continue. The increased efficiency of the plant would help to pay the standard charges on the loan money which was spent on the scheme. In conclusion, Mr. Taverner mentioned that the carrying-out of the contract had been a particularly happy experience for the Council in that it had been undertaken expeditiously and without fuss; and for this he thanked Mr. West. "Perhaps," said the speaker in conclusion, "the most satisfactory feature of the contract is the fact that out of a total expenditure of £62,000, £24,000 has been spent locally."

At a dinner which followed the inauguration ceremony, Councillor SCOTT, replying to a toast, thanked Mr. West for the complimentary references he had made to the Gas Committee and to the City Council generally. The gas consumption in Dunedin, he said, was increasing. For that reason it was necessary to obtain a better class of gas-producing plant; and the plant now installed was satisfactory in every respect, and would, he believed, bring about a reduction in price to the consumers in the city. The work had been carried out by the contractors in a manner that was most satisfactory to all concerned.

The toast of "The Visitors" was proposed by the DEPUTY MAYOR (Mr. J. S. Douglas), and was replied to by the visiting gas engineers—Messrs. JAMES KENNEDY (Greymouth), L. PICKERING (Napier), F. W. J. BELTON (Christchurch), and J. HUNGERFORD (Wellington).

The following is a leading article reprinted from the "Otago Daily Times" for Monday, Sept. 10, 1928:

The ceremonial installation last week of fresh processes of manufacture at the city gas-works marked the completion of an undertaking that was begun over two years ago. The extension and improvement of the plant, which have now been effected, will serve to emphasize the continued importance of the gas-making industry. It may be recalled that the introduction of electric lighting was believed in many quarters to foreshadow the disappearance of coal gas in much the same way as gas itself had superseded the kerosene lamp. There seems at the present day to be no indication of any decrease in the demand for gas. It is perfectly clear, of course, that, as an illuminant, gas has to a very large extent been replaced by electric light. Yet the record of all the gas-works of the Dominion is one of an increased demand for their product; and by none of those who are associated with these works in either a proprietorial or a managerial capacity is any apprehension felt lest gas-making establishments should prove to have outlived their usefulness. The fact is, of course, that the applicability of gas to cooking purposes is being widely and increasingly recognized. It is to the use of the product in kitchen ranges and in smaller cooking devices that the extensive demand for gas is mainly due. In the majority of households there is a regimen of three daily meals; and it is easy to believe that this is reflected in a brisk pressure on the gas mains in the early part of the day, followed by a slackening until mid-day, when the demand freshens up only to be relaxed again for the period prior to the hour when the evening meal has to be prepared. The advantages which the use of gas for cooking purposes possesses are so obvious that the owners of gas-works probably have good cause for confidence in the permanence of the industry that is controlled by them. Moreover, the manufacture of gas-making machinery is an industry in Great Britain which exhibits no signs of decadence. The City Council was apparently fortunate in the Company to which was entrusted the contract for supplying the processes that have now been installed. It is a Company with extensive ramifications of its business, and with a reputation to which gas engineers in the Dominion as a body pay their respectful tribute. The ceremony in this city last week was regarded as of so much importance that the gas engineers from nearly all the largest works in New Zealand came to Dunedin to participate in it. And the most impressive testimony to the value of the undertaking, the completion of which was being celebrated, was contained in their ungrudging and unanimous declaration that the installation is the most efficient that is to be seen in the Dominion.

DESCRIPTION OF THE NEW PLANT.

The following is quoted from a souvenir brochure produced in connection with the inauguration.

The City of Dunedin is situated at the head of Otago Harbour, on the east coast of the South Island of New Zealand. It is the fourth largest city in New Zealand, both in population, which is about 84,000, and as a seaport.

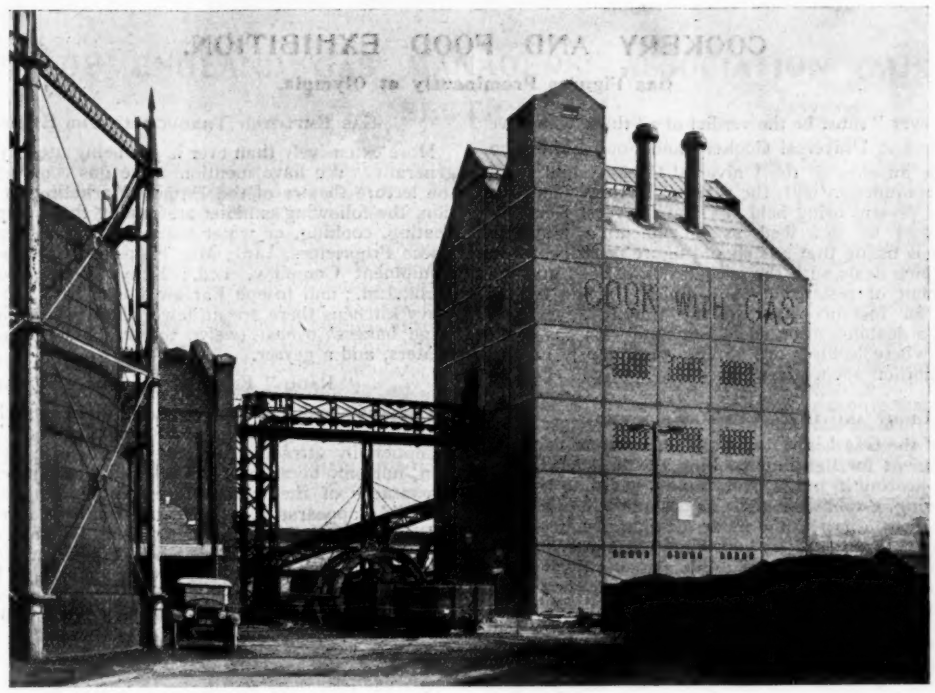
The first settlers who made their appearance as a result of the scheme for the settlement of New Edinburgh—or, Dunedin, as it afterwards became—arrived from Nelson in the year 1844. They were followed in 1848 by a large body of settlers from Scotland, prominent among whom was Captain William Cargill.

The first mention we find of gas being used in Dunedin is in January, 1858, when an enterprising citizen, Mr. G. Duncan, made from tallow gas for lighting the Royal Hotel, of which he was the proprietor.

On July 31, 1862, the Dunedin Gas Light and Coke Company, Ltd., was formed, and the works were erected on the site of the present plant. The streets of Dunedin were first lighted with gas in September, 1863. The purchase of the gas-works by the City Council, for the sum of £43,500, took place in October, 1875. There were then in use some 353 street lamps and 796 meters.

The make of gas for the year 1876 is recorded as 29 million c.ft. The net price of gas to consumers at this period was 12s. 6d. per 1000 c.ft.

Extensive improvements to the works were commenced in 1906. These were completed in June, 1909, at a cost of £53,000, and included a new holder with a capacity of 1 million c.ft. By this time the annual make of gas had increased to 161 million c.ft., and gas was sold at 5s. per 1000 c.ft. This price remained constant until 1917, when an increase of 5d. per 1000 c.ft. took place. In 1925 it was realized that considerable



extension of plant was required to cope with the ever-increasing demand. A proposal to raise a loan of £150,000 for extensions to the works was carried by the ratepayers on Dec. 1, 1925.

The Corporation output of gas has steadily increased, and the works have continuously proved themselves one of the most profitable of the city's trading concerns. There are now 8300 consumers on the Department's books, and a total of over 142 miles of mains have been laid. The annual make of gas is 270 million c.ft., and gas is sold at 6s. 3d. per 1000 c.ft.; the declared calorific value being 500 B.Th.U. per c.ft.

The old carbonizing plant consisted of thirteen settings of 8's horizontal D's with De Brouwer charging and discharging machines, and a De Brouwer chain conveyor for handling the hot coke. In February, 1926, Messrs. West's Gas Improvement Company, Ltd., were entrusted with the contract to supply and erect a complete vertical retort installation capable of producing 1½ million c.ft. per day, with waste-heat boilers and electric lift. New workshops were built in 1926 and 1927, including meter repair shop, carpenter's shop, general store, and demonstration and showroom.

Coal is received into the works in railway trucks carrying an average of 12 tons run-of-mine coal. The trucks are shunted into a new rotary wagon-tipper, manufactured by Messrs. Strachan & Henshaw, which has a capacity of twelve trucks per hour. This completely empties the trucks into a grabbing pit, from which the coal is taken by a clam-shell grab operated from a newly installed Morris bottom-flange telpher of 40 tons per hour capacity. The telpher track extends 700 ft., and passes over the coal-breaker receiving hopper into the coal store, and past the new retort house over the coke store. Coal taken from the grabbing pit is by this means taken into the store or dumped into the breaker receiving hopper. From this hopper it is fed by a reciprocating tray with adjustable stroke to a West four-roll breaker, by which it is reduced to 2-in. cubes. The broken coal then passes down a chute into the lip-bucket conveyor, for which no mechanical filler is required, and is conveyed direct to the overhead bunkers.

Owing to the unstable nature of the subsoil at the site of the new retort house, particular care was necessary in the designing of a suitable foundation. Boring operations carried out on the site and in the vicinity to a depth of 500 ft. showed that the subsoil was composed almost wholly of harbour silt. The foundation design was entrusted by Messrs. West's Gas Improvement Company, Ltd., to Mr. Burnard Geen, of London. The type decided on was a reinforced concrete cellular raft, the whole area of which was enclosed by ferro-concrete sheet piles to prevent the subsoil spreading under load. The excavation work was started in May, and the foundations were completed by the end of October, 1927.

Vertical Retort Installation and Auxiliary Plant.

The vertical retort installation comprises three beds of eight "New Model" steaming retorts; each bed being provided with a waste-heat boiler of the West-Galloway vertical type. An electric lift is installed, and all mechanical parts of the plant are electrically driven. Coal and coke handling are effected by a West lip-bucket conveyor of 50 tons per hour capacity (broken coal). Coke is discharged into skips, and is either conveyed by telpher to the yard or fed by chute into the lip-bucket conveyor, and carried to an overhead coke storage hopper.

The auxiliary plant comprises one atmospheric condenser of 600,000 c.ft. per day capacity, and one new set of Walker water-tube condensers of 1½ million c.ft. per day capacity; two sets Walker exhausters capable of passing 60,000 c.ft. per hour, driven by horizontal steam engines; two Livesey washers of 1 million and 1½ million c.ft. capacity respectively; one Holmes rotary scrubber of 1 million c.ft. capacity; four purifier boxes (each 30 ft. square) fitted with Milbourne valve arrangement, which provides for upwards or downwards flow, and in any desired direction; a station meter of Messrs. James Milne & Sons' manufacture, capable of registering 60,000 c.ft. per hour; four gasholders, the total capacity of which is 1½ million c.ft.; and a new "T.I.C." dehydrating plant, capable of treating 10 tons of crude tar per day, manufactured by the Woodall-Duckham Company.

"A. & M." METERS.

A Booklet of Singular Interest.

Messrs. Alder & Mackay, Ltd., of Edinburgh, have published a highly interesting booklet on the subject of meters—the type of brochure which it is a pleasure to read, instead of consigning it to the waste-paper basket. A few extracts from the publication will doubtless prove entertaining to our readers.

Six years have elapsed since the introduction of the standard meter—an endeavour jointly made by the gas industry and the meter manufacturers which has proved entirely satisfactory. The No. 2 Standard is now accepted as a robust and dependable offspring of its ancestor the 3-light, though delivering more than double the hourly load through the same case. The argument applies throughout the whole series. Messrs. Alder & Mackay explain that these results were not achieved by merely altering the nomenclature of the meter. They endowed the No. 2 and the No. 3 with much larger and more efficient diaphragms, valves, and gas ways than their forefathers in the lights class were ever blessed with; while their efficiency and appearance were also enhanced by the adoption of four circle indices, enclosed by strong plate glass. The firm recently received from South Wales a 3-light prepayment meter which had been in constant use since 1900 without repair. "Registering correct within the Sales of Gas Act, it was in astonishing good health after fully twenty-seven years' hard labour."

Messrs. Alder & Mackay make the popular sizes of high-capacity meters—viz., 80 c.ft. per hour in 3-light case with 5-light connections; 120 c.ft. in 5-light case with 10-light connections; and 240 c.ft. in 10-light case with 20-light connections.

The "A. & M." high-capacity meter is constructed with a higher capacity per revolution, and is not, therefore, merely speeded up to give the larger capacity per hour. The 80 c.ft. size has a revolution capacity of 0·25 c.ft., and consequently performs 320 revolutions per hour at maximum load, which is a reasonable speed.

COOKERY AND FOOD EXHIBITION.

Gas Figures Prominently at Olympia.

"Better than ever" must be the verdict of all those who have visited the thirty-first Universal Cookery and Food Exhibition which, under the auspices of the Universal Cookery and Food Association, in conjunction with the "Hotel Review" and the "Caterer," is at present being held at Olympia, West Kensington. It may well be described as an epicure's four-acre paradise; and it is fitting that gas should figure prominently in an exhibition which deals with the preparation of food and the culinary equipment of restaurants and clubs. In the largest exhibit of all, for instance—that of the Empire Marketing Board—there is a demonstration room complete with gas cooking equipment, where lectures are almost continuously in progress. The exhibition opened on Friday last, and will close on Dec. 1.

Gas Light and Coke Company's Stand.

The exhibit of the Gas Light and Coke Company consists of the latest equipment for lighting, cooking, water heating, refrigeration, and heating in hotels, restaurants, boarding-houses, and other catering establishments. As gas heating is now playing so prominent a part in the modernization of hotels, and "gas fires in every bedroom" is becoming a common feature in the advertisements of the leading establishments throughout the country, a special display has been provided to show how hotel keepers are heating their bedrooms hygienically without creating labour—and are incidentally increasing their own profits thereby. There is a model hotel bedroom equipped with a radiant ventilating gas fire, and nearby is the unobtrusive little bedroom gas fire meter into which the hotel visitor places the necessary coin whenever instant warmth and comfort are desired. Another part of the exhibit consists of a hotel panelled lounge hall with handsome fires in beautiful settings, and artistic gas lighting fittings which can be turned on and off by means of switches.

A small gas-operated refrigerator is shown in the kitchen. This is suitable only for a small boarding-house, but its method of operation is similar to that of the larger gas-operated refrigerators which are now being adopted extensively in restaurants and other catering establishments. The great advantages of this type of refrigerator are its absolute silence in operation, its reliability, and its economy. It has no moving parts and is operated by a small gas flame.

A gas-heated cabinet for drying and airing linen, blankets, towels, and the like is another device which will undoubtedly be extensively adopted by the hotel and catering trade, once its economy and efficiency are fully appreciated. By regulating the supply of gas, the wettest articles can be quickly dried; alternatively, it may be used as an airer, when the gas consumption can be reduced.

The gas cooker shown is one of the latest types finished in porcelain enamel. This new finish has been taken up enthusiastically by the general public on account of the ease with which it can be kept spotlessly clean. The enamel finish provided is the result of a newly discovered process, and is so hard that it will withstand all normal wear and tear over a long period. All taps are nickel-plated, and the oven is equipped with a device for automatically maintaining any desired working heat.

The whole display gives one the impression that the gas industry is a very "live" one—quick in adopting new appliances and improvements on existing ones, as soon as careful tests have proved them to be sound in theory and in practice.

Gas Employed Throughout the Exhibition.

More extensively than ever is gas being used by the exhibitors generally. We have mentioned the gas cooking equipment in the lecture theatre of the Empire Marketing Board. In addition, the following exhibits are among those employing gas for heating, cooking, or water boiling: H. J. Green & Co., Ltd.; Lacco Proprietors, Ltd.; Mac Fisheries, Ltd.; Staines Kitchen Equipment Company, Ltd.; Kenya Coffee Company, Ltd.; Virol, Ltd.; and Joseph Farrow & Co., Ltd. In the Army and Navy kitchens there are no fewer than twenty-six cookers, two large bakers' ovens, twelve toasters and grillers, two water heaters, and a geyser.

"Rado" Enamelled Hotel Apparatus.

Radiation Ltd. have an extensive and comprehensive display of hotel and restaurant gas-fired appliances. Their stand is exceptionally attractive, and is creating a great deal of attention, not only because of the scientific, economic, and practical advantages of the apparatus on show, but because of their splendid appearance. Practically all the appliances are "Rado" enamelled in mottled finish; and the general effect of cleanliness is most striking. The exhibiting firms are Arden Hill & Co., the Davis Gas Stove Company, Ltd., Fletcher, Russell, & Co., the Richmond Gas Stove Company, Wilsons & Mathiesons, Ltd., and John Wright & Co.; and on a separate stand is the Eagle Range and Grate Company.

Hot Water Apparatus.

Several firms are showing gas heated hot water apparatus. Among the exhibits of Ewart & Son, Ltd., are their "Califont" automatic hot water heater and their "Quick Supply" boiler. The latter, which is fitted with four draw-off taps, and is also automatic in action, provides boiling water in large quantities at the shortest notice. "Ever Ready" boilers and "Brilliant" geysers are featured on this stand.

Another fine display of gas-heated hot water appliances is that of James Stott & Co. (Engineers), Ltd., who, in addition to showing water boilers, ham cookers, food steamers, and so on, are demonstrating the "Stott" automatic gas governor for use with cooking apparatus.

"Jackson" café fountain boilers and still room heaters are to be found on the stand of Jackson Boilers, Ltd., who have a most imposing display.

Further Interesting Exhibits.

Further interesting exhibits are those of the Carron Company, the Falkirk Iron Company, Ltd., and Benham & Sons, Ltd. The first-named firm have been specializing in cooking apparatus—from the gas ring to the installations of the largest hotels, restaurants, and canteens—for nearly 170 years; and their display of gas hot closets, grills, boiling pans, &c., is well worthy of a visit. The Falkirk Iron Company are demonstrating "Falcon" gas ranges, boiling tables, baking ovens, &c.; and Benham & Sons have an exhibit of gas-heated central and wall ranges, carving tables, hot closets, and so on.

Before terminating this note on what is a most stimulating exhibition—a display which throughout draws attention to the remarkable part which gas plays in the skilful and hygienic preparation of food—we must refer to still another application of gas in relation to food. This is exhibited on the stand of Electrolux, Ltd., who feature their gas-operated "Electrolux" refrigerator.

BRITISH GAS LIGHT COMPANY.

New Recreation Hall at Norwich.

The new hall which the Directors of the British Gas Light Company, Ltd., have provided at Norwich for their local staff and employees was opened on Nov. 19 by the Lord Mayor; a large company attending the function.

The hall, which is to be used for social and recreative purposes, has been built on that portion of the Company's premises which abut on Gas Hill and Rosary Road. In front is a splendid bowling green, another of the recreative provisions which have been made in recent years. The hall, which is comfortably furnished, will seat 300 people, and it is equipped with a commodious stage, a lantern chamber, kitchen, &c. Mr. Henry Woodall, Chairman of the Board, presided at the opening ceremony, and was supported, in addition to the Lord Mayor, by the Engineer and Manager, Mr. Thomas Glover.

In welcoming the Lord Mayor,

Mr. WOODALL spoke of the importance of looking after the welfare of the staff and employees. Everybody at the works recognized that Mr. Glover was doing all he could in that direction. The hall was the outcome of a desire on the part of the men for somewhere where they could all meet; and it was very satisfactory to be able to say that every member of the staff, and every workman, was supporting the scheme, and would subscribe a small sum weekly to provide for the upkeep of the hall, and meet the nominal rent. The Directors had provided the necessary capital for its erection.

Mr. GLOVER referred to the steady growth of the social work in connection with the works. They had now a sick club, which, started by the men themselves, had become very popular. The one drawback was that they had no place to meet, except the messroom at the St. Martin-at-Palace Works; and he was approached with a view to a hall for other forms of recreation. The Directors had very generously provided that hall.

The LORD MAYOR, who was cordially received, said that the hall was very suitable for the purpose to which it was dedicated. The Company, he continued, was a great public utility, and as such, therefore, had its responsibilities. As long as it carried out those responsibilities to the credit of itself and the benefit of the citizens, it need not fear what the future had in store for it.

The Lord Mayor then formally declared the hall open, and was suitably thanked by the Chairman.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION (AUXILIARY SECTION).

The Eighteenth Half-Yearly Meeting of the Auxiliary Section of the North of England Gas Managers' Association was held at the Howdon Works of the Newcastle-upon-Tyne and Gateshead Gas Company on Saturday, Nov. 24.

Mr. G. E. ANDERSON, Manager at the Howdon Works, presided, and, in extending a welcome to the visitors, expressed pleasure at seeing such a large number present.

Mr. A. H. BAGSHAW (Secretary) read the following statement on the Education Scheme, prepared by Mr. C. Dru Drury, Chairman of the Sunderland Area District Committee.

THE EDUCATION SCHEME.

Classes under the Institution of Gas Engineers' Education Scheme have been in full swing at Rutherford College, Newcastle, since September last, and the numbers of students registered are as follows:

MAJOR COURSE.

	No. of Students.
Gas Engineering (Lecturer, Dr. W. B. Davidson.)	
Ordinary Grade (1st year)	1
,, ,, (3rd ,,)	7
Higher Grade (4th ,,)	10
MINOR COURSE.	
Gas Supply Practice (Lecturer, Mr. F. W. Craggs.)	
First year	16
Second year	14
CITY AND GUILDS OF LONDON INSTITUTE.	
Gas Fitting (Lecturer, Mr. Wm. Batt.)	
T,	12
Total	60

The students are drawn from an area approximately bounded on the North by Alnwick, on the West by Hexham, and on the South by Durham. It is hoped that for the Session 1929-30, provided a sufficient number of students is forthcoming, a centre may be formed, possibly at Middlesbrough, to serve the southern section of the Association's area. Potential students for next session should make themselves thoroughly acquainted with the contents of the "Green Book" giving regulations, &c., in connection with the Education Scheme, so that they may ascertain what is required of them before they enter for next year's classes. Those who have not already a copy of this book can obtain one on application to the Hon. Secretary, Mr. H. Lees, Gas Office, Hexham.

One of the difficulties which the District Committee has had to face is the fact that some of the students, while competent, so far as gas engineering or gas supply is concerned, to enter a certain course, cannot produce evidence that they have received instruction in all the ancillary subjects up to the standard required for that course. The Executive Committee in London lays great stress on the difference between "instruction" and "experience." The former can only be obtained—so far as internal students are concerned—through classes in recognized technical colleges and schools. In the forthcoming year there should be no difficulty under the co-ordinated scheme of ancillary subjects for youths to concentrate on those subjects which are essential.

To those students who are sufficiently ambitious to aim at the Diploma in Gas Engineering or Gas Supply, it should be emphasized that previous Matriculation is essential for the entrance to this examination; and those members of the Association who have a voice in the appointment of youths to vacancies in the technical departments of gas undertakings are strongly urged that they should give sound advice on this matter, and point out to those youths who have had the benefit of a secondary education, but who have not matriculated before leaving school, the desirability of doing so as soon as possible.

On the motion of the CHAIRMAN, a vote of thanks was passed to Mr. Dru Drury for his report.

THE ADDRESS

of the CHAIRMAN, Mr. G. E. Anderson, B.Sc.

In formally thanking you for the high honour of election as Chairman of this Section, which I received at your hands at our last meeting, I trust that I may be fortunate enough to obtain your support during the coming year, and that the increasing vitality and interest of our meetings will be fully maintained. As an Association we have, in common with other similar associations throughout the country, every reason to look forward to our future meetings with enthusiasm, for the profession of gas engineering in all its branches is becoming more absorbing year by year, and the development of the industry in relation to the problems which have to be considered in the near future is bound to be of extreme interest.

Since the last visit of the Section to these works four years ago, the then proposed amalgamation between the Newcastle-upon-Tyne and Gateshead Gas Company and the Walker and Wallsend Union Gas Company has been carried into effect, and the Howdon Works has now fallen into line as one of the manufacturing stations of the former concern. In view of the prominence which is being deservedly focussed on the subject of amalgamation as a policy for strengthening the position of our industry, I feel it may perhaps prove of interest if I devote the time at my disposal to a summary of some of the more important changes actually effected in the present instance.

The general benefits claimed for the policy of amalgamation are fairly obvious, and have often been enumerated, and I do not propose to touch upon them, but to deal more particularly with differences in actual works practice which are directly attributable to the amalgamation, and to indicate how they have been of benefit or otherwise when looked at, in the first place, from the point of view of the absorbed undertaking. In combining the activities of neighbouring concerns, the fundamental principle should be that of mutual benefit, and it is at first sight a somewhat surprising fact that the smaller undertaking emerges, as a rule, with the lion's share of the advantages. On theoretical grounds, this is to a certain extent a natural consequence, for however efficient a works is in a self-contained capacity, its association with a larger concern places it in a favourable position for participating in various schemes and policies which are too ambitious for a small company. This appears to have been the case at Howdon in a marked degree and in many directions.

So far as the condition of affairs existed prior to the absorption, there can be little question that under the Walker and Wallsend Union Gas Company the Howdon Works constituted a thoroughly up-to-date, efficient, and economical station. The lay-out of the plant was carefully designed to permit easy extension to meet future requirements, and the geographical configuration of the site had been exploited to the full, with the result that labour charges, particularly for such items as coal handling and coke loading, were very low. With the exception of the sulphate of ammonia plant, which was due for renewal, the whole of the plant was modern and in good condition, and possessed a reserve capacity of 25 p.ct. reckoned on the winter peak load. The district was also in a similar flourishing condition; for, though the works are situated at the eastern extremity of the district, the Company possessed reserve holders at Walker and at Willington Quay, and no difficulty was experienced in maintaining adequate pressure at all points. The output of gas showed steady development, and the last year of the old Company's activities was a record in the history of the undertaking. It was, therefore, not easy to visualize where any great improvements could be effected, apart from the general savings on administration; but actually a surprising number of advantages have been gained, particularly so far as the works are concerned; and their cumulative effect has been to increase the efficiency and reduce the working costs to figures which probably could not have been reached by the works operating independently. This has naturally been of benefit both to the works and to the Company as a whole; and the main factors which have contributed to this end may be summarized and briefly explained as follows.

(1.) INTRODUCTION OF NEWCASTLE SYSTEM OF COSTINGS.

Every works naturally finds it essential to employ some system of costing, but the degree to which detailed sub-division can be carried out is generally limited by the amount of time and labour which can be devoted to it. In common with that of many other medium-sized works, the Wallsend system was designed on simple, though fairly adequate, lines; a medium degree of sub-division only being attempted in order to make it possible for the whole of the work in connection with it to be carried out by the limited clerical staff at the works. The Newcastle system, which was referred to by Mr. T. P. Ridley in his Presidential Address to the North of England Gas Managers' Association last year, is, on the other hand, one of the most comprehensive and up-to-date schemes in use, and is fully justified owing to the large scale of the Company's operations. Its introduction at Howdon has unquestionably been of great advantage both in providing an accurate and comprehensive analysis of weekly costs in all departments, and, more especially, in focussing attention, by virtue of its detailed sub-division, on all expensive items, and thus encouraging further economies. An added incentive towards reduction in working costs has also been provided by the comparison with other manufacturing stations of the Company; the costs being reckoned on the same basis at all works, thus avoiding the danger of comparing figures which are not truly comparable, which often happens when published costs of some other company are used as a standard. This friendly rivalry and collaboration between the various works of the Company will be

referred to later, and is undoubtedly a valuable factor towards efficiency.

While dealing with the question of cost systems, reference might perhaps be made to a feature which becomes more evident as the system is developed—namely, that the advantages gained are not confined to the information which is constantly to hand regarding working costs. Thus, for instance, a proper stores record system is a guarantee against the depletion of stocks at what may be inconvenient moments. A job card is a record not only of the cost of a job, but also of the length of time taken, and the date when the work was done—information which might be valuable at some future date and which otherwise might be difficult to obtain. The check of job cards against time cards automatically obviates the possibility of mistakes in wages calculations; and many other instances could be given illustrating how the introduction of an up-to-date system is useful in promoting smooth and regular working. To my mind, the running of a works under a complete system such as that adopted by the Newcastle Company is in many ways comparable with the running of a machine fitted with mechanical control and recording instruments; and the same benefits apply in both cases—namely, better efficiency, greater accuracy, and the liberation for more important duties of the supervision otherwise required.

(2.) Introduction of Weekly Summaries.

Previous to the amalgamation it was considered sufficient to summarize all working results monthly, mainly owing to the difficulty, in our case, of gauging coals carbonized accurately over a shorter period, on account of all coals having to pass through the store. With the Newcastle system, complete sheets are prepared weekly, and each day's working in the retort house is summarized separately. The necessity for working to this shorter period has directed attention to the question of accurate stocktaking; and a system has been devised whereby the coals carbonized can now be determined very closely under normal conditions. The advantage of having this information available from day to day is that fluctuation of results is noticed immediately, and prompt steps can be taken to rectify matters.

Though the full working results for a period of one week can only be looked upon as more or less approximate, the figures are circulated among the various manufacturing stations, and friendly rivalry in regard to carbonizing efficiencies is thus secured. Further, conferences of the Works Managers are arranged under the chairmanship of the Chief Engineer, in order to discuss useful comparisons of results over longer periods, and methods of working and organization. While the effect of such factors is difficult to assess, it is obvious that a works possessing these advantages is likely to do consistently better than an isolated works, where, owing to the frailty of human nature, moderate results are sometimes apt to be regarded as satisfactory so long as routine working is smooth and serious trouble is avoided.

(3.) Regulation of Outputs.

In all works it is generally found that manufacturing costs are lower with certain definite outputs than with others, depending on whether the carbonizing labour in the retort house is fully occupied or otherwise. Thus, for instance, where ten beds constitute full working for (say) four men, the lighting-up of the eleventh entails a 25 p.ct. increase in the labour cost for a 10 p.ct. increase in gas yield, and the extra gas is therefore not produced economically. In the case of a single works supplying a definite district, little or no regulation of outputs to suit economical units is possible, unless the storage capacity is very high, or a water gas plant is available; and the result is that probably for the greater part of the year the costs of producing gas are higher than need be. The costs at Howdon were to a certain extent unavoidably handicapped in this way previous to the absorption; and the linking-up of the district with that of Newcastle has resulted in a considerable improvement, in that the daily delivery—thanks to carburetted water gas plant being available at other works—has been more or less regulated to suit whatever output is desired from the retort house.

In addition to the economies obtained in this direction, a further reduction in costs has been brought about as a result of increased deliveries due to extending the district of supply. By interconnection of mains at various points along the western boundary of the Wallsend district, and particularly by a trunk main taken from the Walker gasholder station, a considerable quantity of gas manufactured at Howdon has been distributed in the adjacent area of Heaton. As this extra gas has been produced without the necessity of adding to the existing labour, and therefore virtually at the cost of net coals, the effect has been to reduce the overhead charges for manufacture, purification, and supervision over the whole of the yearly make. From actual experience under our own conditions, this factor of extra throughput has been a particularly effective ally in reducing costs into the holder; and inasmuch as there still remains a considerable margin before the saturation point of either the plant or the labour as at present organized is reached, there is definite promise of still further economies. Under the old conditions these advantages would have been obtained gradually, depending on the normal rate of increase; and the fact that the savings have been realized immediately must be credited as one of the benefits these works have gained from the amalgamation. A further extremely valuable feature which may be mentioned under this heading is that following the interconnection of the districts, the peak loads in the demand have been smoothed out to a marked degree, with the result that very little difficulty is experienced in dealing with a daily delivery of over two millions with a variation in the holder stocks of less than half-a-million.

(4.) Transference of Labour and Materials.

Innovations which lead to extra convenience in working may be classified as advantages equally with those which result in reduced costs; and in many cases, when the first object is achieved, the second usually follows, provided the efficiency of working has not been adversely affected.

Among the many changes under this heading which have been introduced, one of the most important is the development of an arrangement for transferring labour, materials, and in some cases plant, from one works to another, where, owing to the particular requirements of the moment, better use can be made of them. This arrangement has a twofold advantage in that extra trained labour is available when required for special work or for rush periods, and surplus labour during normal times is largely avoided without definitely dispensing with the men. In practice this has been of considerable value in connection with retort setting repairs, particularly in the direction of transferring the regular Howdon retort setters to other points during the slack periods between successive yearly programmes. A considerable proportion of wages for painters and other trades has also been saved in a similar manner, and on the other hand welcome temporary assistance has been obtained on several occasions for general repairs, railway track alterations, rush coke deliveries, &c. This point illustrates again the advantages which are being gained as the result of mutual collaboration between the different works and other departments of the Company.

(5.) Stores and Contracts.

The saving on large-scale contracts is one of the obvious benefits of all amalgamations, and the principle of combining the Howdon requisitions with those of other works has naturally been adopted, and the whole of the business both in buying coals and stores and in selling residuals is done by one central department. The working of the system with regard to stores is very simple, and it avoids the normal weaknesses associated with schemes of this kind by the general policy of the Chief Engineer in standardizing the requirements of the various works as far as possible, and further by the freedom which is given to works managers to specify particular commodities where these are justified. In addition to the savings in cost on practically all items, the introduction of the system has, from the works point of view, avoided the previous necessity of obtaining and deciding on competitive tenders, and all the clerical work attached thereto.

(6.) Standardization of Chemical Methods.

For various more or less unavoidable reasons the chemical department of a small works operating singly is not in a favourable position for dealing adequately with the many problems which come within its scope. The available staff is necessarily small, the expenditure on apparatus has to be kept within reasonable limits, and the amount of essential routine work which has to be done leaves little opportunity in which to carry out special investigations of any kind. The valuable work that is nevertheless accomplished, and the indispensable nature of the assistance given in connection with the proper control and supervision of plant, go far towards obscuring these handicaps; and it is only when comparison is made with the chemical activities of a large undertaking that the practical effect of these limitations is fully realized. Under the new conditions at Howdon, the works are in a position to benefit in all the advantages to be derived from a chemical department worked on modern lines and on a large scale; and the effect of better facilities has been felt in many directions. Thus, for instance, by the introduction of uniform and carefully standardized methods of analysis—a very full list of which is recorded on the card index system for easy modernization of any method when necessary—it has been possible to extend the amount of routine work previously done in the works laboratory. In addition, any special investigations can be referred to the Chief Engineer's department, where the central laboratory is suitably equipped for dealing with them. A particularly valuable feature in this respect is the testing of both special and routine consignments on the coal test plant; the results being in all cases fully reported and evaluated, and given to the works managers for their private use. Further advantages lie in the checking of all important tests by the central laboratory, in the comparison of difficulties and methods of working of sulphate and benzole plants, &c., with other works, in suggestions received for looking into special points, and in the systematic recording and summarizing of all results.

Individual members of the engineering and chemical staffs have also benefited by being transferred to other works from

time to time, thus affording them opportunities for becoming familiar with a wider variety of plant.

(7.) Alterations and Extensions to Plant.

Since the absorption, the advice and assistance of the Chief Engineer's staff has been available in connection with alterations and extensions to plant, and the complete renewal of the sulphate plant, a substantial extension to the coke yard, alterations to the railway lay-out, transfer of the coke crane track to a new site, and an addition to the overhead tar storage afford instances where valuable assistance in the way of drawings and supervision has been forthcoming.

(8.) Workmen's Conditions.

The points mentioned so far are concerned more particularly with differences in policies and methods of working between the old régime and the new; and while many of the minor alterations may be omitted, the list would not be complete without reference to the effect of the absorption so far as the employees are concerned. It is easily understood that this matter is of extreme importance to the workers themselves; and the worst feature of many large industrial amalgamations is undoubtedly the lack of consideration given to employees of the absorbed concern. In this particular instance little anxiety has been felt, and actually it must be said that, though the workmen's conditions were good before, they are on the average better now. Regularity of employment is just as much assured, and rates of pay and holiday concessions are in many cases better. The old Co-Partnership Scheme, which had much to recommend it, has unfortunately had to be discontinued, but its place has been taken by the Pensions and Widows and Orphans Scheme, which is recognized as one of the best of its kind in the country. A Sickness Benefit Society and Welfare Scheme has also been introduced recently, and ambulance classes have been organized. In all these schemes the Wallsend employees have been invited to participate on an equal footing with the Newcastle employees; and it is very pleasing to be able to state that, apart perhaps from the sentimental regret at the passing of the old Company, which it would be foolish to attempt to conceal after such a short period, the employees as a body appreciate the fact that the amalgamation has in several ways brought them definite benefits.

Disadvantages.

In assessing the total practical value of the absorption strictly from the works point of view, due allowance must be made for those changes which experience has shown to be in the nature of disadvantages. These are bound to exist with practically all schemes, even if they amount to nothing more than sacrifices made to ensure greater benefits. In the present case it can be stated definitely that the disadvantages are nothing like so self-evident as the advantages.

Practically the only matter which needs to be mentioned under this heading is the alteration in the declared calorific value from 525 B.Th.U. to 500 B.Th.U. In a paper which I had the opportunity of reading before this Section in 1924, the suitability of the former standard from the point of view of the plant in operation was specially emphasized, and a summary of actual official tests over a period of twelve months was given with the object of illustrating the effectiveness with which the variations from the declared value could be kept within narrow limits. The other manufacturing stations of the Company, being equipped with water gas plant and continuous verticals, naturally find a lower declared value more convenient, and previous to the amalgamation were supplying 475 B.Th.U. gas. With the linking up of the district and the consequent necessity for a uniform value, the mean figure of 500 B.Th.U. was chosen, and our experience with plant consisting solely of horizontal retorts has been that, with careful supervision and with slight alterations in operating the plant—particularly so far as benzole extraction is concerned—the new value, though not so convenient as the old, can be adhered to with consistency, and actually the variations in the daily average are now, if anything, less than before.

One other matter might be included under this heading, though it belongs to a different category from the previous point, and is more in the nature of an illustration as to the value of the absorption from the Newcastle Company's point of view. Coke handling and coke storage problems vary enormously in different works, and, as previously mentioned, Howdon is in a very favourable position for handling comparatively large stocks at very economical figures, particularly since the original advantages in this respect have been greatly improved by recent extensions. In the case of poor coke markets, therefore, the best policy from the Company's point of view is to continue stocking at Howdon, and to dispatch what shipments are available from those works which are not so well placed with regard to coke handling facilities. With this policy in continual operation, the total costs for coke at Howdon are likely to be increased above the level at which they could be maintained if the works were operating singly; but as it is to the benefit of the Company to do so, the point can hardly be termed a disadvantage, except from the narrow point of view.

Advantages to the Newcastle Company.

As previously mentioned, the Howdon Works appear to have obtained the lion's share of the practical benefits of the absorption; and without actual experience of the Newcastle conditions, both before and after the change-over, it is somewhat presumptuous to say definitely what advantages have been gained on the other side. The points which suggest themselves, however, though perhaps not numerous, appear to be of considerable ultimate value. Thus, for instance, the Howdon Works as they stand at present, in addition to lending themselves to easy development, are conveniently equipped for undertaking large-scale tests either of special coals or of new processes. The large coke storage capacity has already been mentioned, and the position with regard to coals, tar, and liquor is equally favourable. Many of the points referred to as Howdon advantages—as, for example, regulation of outputs, competition regarding costs and carbonizing results, and transference of labour, &c.—might be said to apply also in this direction, though their effects may possibly be felt in a lesser degree. It is important to note that none of these suggested advantages would have been available if the policy of centralization of manufacture, the advisability of which has to be carefully considered in all amalgamations, had been followed in this case. The entirely different set of circumstances which would have resulted from an absorption on these lines would probably have introduced certain alternative advantages, but it is very unlikely that these would have outbalanced the sum total of economies and provision for future developments that have materialized from the policy which has been adopted.

In summarizing the actual value and effect of the points which have been mentioned, it need hardly be said that the correct standpoint is not taken by estimating what this works has gained or how the other works have benefited. These viewpoints have been adopted here simply as a means of indicating how the Company as a whole has profited from the amalgamation; and when it is borne in mind that only points dealing with the manufacturing side have been considered in this account, and that with these must be associated advantages from the financial, administrative, and distributing aspects, there can be no question that the policy of amalgamation has been amply justified. How far the position of the Company has improved in relation to the ultimate object of being able to produce and sell gas at a cheaper price could, perhaps, be indicated statistically; but the difficulty in this respect lies in correctly estimating the commercial values of all the changes which have been introduced, some of which, as has been shown, are psychological rather than technical. Allowance would have to be made also for the fact that present working and results have been influenced to quite an appreciable extent by improvements and alterations which are largely independent of the amalgamation—as, for example, on the manufacturing side, the greater use of silica retorts and adoption of heavier charges, &c. Again, a fair comparison between the total working costs before and after the change is rendered difficult on account of the effects produced by the coal stoppage during the intervening period. In dealing, therefore, with the manufacturing aspect of the amalgamation from a general standpoint, rather than by attempting to evaluate its benefits in actual figures, I do not think the conclusion is any the less obvious that the policy has been of very definite value in strengthening the position of gas in this district.

Problems of the Future, and Their Opportunities.

In leaving the subject of amalgamation, might I direct attention to one aspect of this and of the other problems at present facing the industry—that is, the almost unlimited opportunity for study which they offer, particularly to those of us who may be classified as belonging to the younger generation of gas engineers. Much is being said of the value of the Education Scheme of The Institution of Gas Engineers, as a means of preparation for future responsibility; and with this view there is universal agreement. But the successful control and management of gas undertakings to-day, and probably to a much greater extent in the future, depend on more than technical knowledge and practical ability to deal with the problems which occur within the walls of the gas-works or the confines of the district. A brief consideration of the larger and more fundamental questions which will have to be considered and decided upon, and of which amalgamation is a typical example, suggests that the trend of future development is likely to be along different lines from those of the past. From a manufacturing point of view, the question of co-operation with other industries—*e.g.*, collieries, coke ovens, and low-temperature processes—will demand the fullest possible attention, in view of their importance from a national standpoint. Similarly, on the distribution and sales sides there are the questions of long-distance transmission, maintenance schemes, improved systems of charging for gas, and competition with a reorganized electricity industry. Some of these matters and policies are already in active operation to a certain extent; others are in the experimental stage; and the remainder have progressed only to the point of being proposals. The time which must elapse for their full development should be accepted by all of us as an extremely valuable opportunity to make ourselves thoroughly familiar in detail with the pros and cons of the proposals, and to study their full significance with regard to the well-being both of the industry as a whole and of individual undertakings in particular. The better equipped the future generation is in respect of the power to appreciate technical and commercial

values, and to advise and direct policies, the more successfully will the industry emerge from its contact with these problems. It has been said recently, and with every justification, that the industry is in good hands at present. Let us regard this as an inspiring example, and make the most of every opportunity in order that the same may be said of the future.

Mr. W. L. ROBERTSHAW (Sunderland) proposed a vote of thanks to Mr. Anderson for his address. It fully maintained the traditions of the past, and, indeed, set a standard for the future. He had been a regular attender at all the meetings of the Auxiliary Section since its formation in 1920; and he was sure that as time went on the meetings showed increased enthusiasm. He visited the Howdon Works four years ago, when the Chairman gave a very able paper. He agreed with Mr. Anderson that a costing system was very desirable; but, to be comparable, costs must be on the same basis at all works. Weekly summaries of working results were essential, as they immediately indicated the weak places, and any slackness could be detected and rectified. He had a system by means of which he could get an accurate stock of coal weekly when working under normal conditions, and by that means could check the figures from the commencement of the year. This enabled him to know exactly what results were being obtained from the commencement of the year. The transference of labour and material from one works to another during rush periods, and thereby getting trained labour instead of casual, must tend to reduce costs, besides improving the conditions for the workmen. He envied Mr. Anderson, with his ample area for coke storage and cheap methods of loading. He endorsed the remarks of the Chairman as to the value of the Education Scheme, and impressed upon all juniors the necessity of getting their Diploma; for only to the men with the necessary qualifications would fall the honour of directing the future of the gas industry.

Mr. J. E. DIXON (Elswick Gas-Works), seconding the vote of thanks, said that in previous years Mr. Anderson had worked hard for the good of the Section. He had been a member of the Committee for some time, and had given the members valuable assistance.

The CHAIRMAN briefly returned thanks.

WALES AND MONMOUTHSHIRE JUNIOR GAS ASSOCIATION.

Meeting at Cardiff.

The Second Meeting of the Session took place at the Gas Offices, Bute Terrace, Cardiff, on Saturday, Nov. 10—Mr. C. B. FELTON (the President) occupying the chair.

At the outset the PRESIDENT asked the members to stand as a token of sympathy at the loss of one of their colleagues, Mr. R. P. Jones, who had recently died.

MEETING CONSUMERS' REQUIREMENTS.

By J. HISLOP, of Newport.

When a complaint is received that the gas bills are getting heavy, or that the lights are bad, or that the cooking takes much longer now than it used to do, the cause may be that the service pipe is partially choked with rust or salts. If the service is an old one, it will be better to renew it, at the same time laying a pipe of larger bore, if requirements demand. If the service is not old, the stoppage may be due to the presence of salts; and in this case the careful use of the force pump or of spring rods will be found effective. If there is a complaint of "jumping lights," this may be due to a sag in the pipe, and the collection of water therein. The force pump will remove this for a time only; and it is advisable to straighten the pipe. If it is not possible to remove the dip, and it is necessary to fit a tail syphon, the latter should never be fixed underground. A syphon pot should be fitted at ground-level at the point where the water collects, with a suitable box over it. All such syphons should be recorded on the official records of syphons, and attended to from time to time by the syphon man.

METERS.

The complaints generally found with ordinary meters are due to stopped registration, there probably being a slight escape at the dial glass, or a leak at the seams. The same applies to prepayment meters with an occasional leak at the coin box. To prevent dial glasses being broken, we have commenced to use heavier glasses. In all the above cases, the meter will have to be changed. If a meter becomes corroded, the cause must be ascertained. It may be that the surroundings are damp; and in such circumstances it is advisable to find a more suitable position for the meter. If the meter is fixed outside the premises, or in a pit, one with an iron case should be used. Again, a meter may have broken down on account of an excessive load; and here I might say it is the duty of every distribution man to check the consumption of the apparatus against the size of meter. There is no doubt that owing to this defect alone gas companies experience great losses every year. There are still in use hundreds of 3-light meters supplying gas for a cooker, fires, and lights, and sometimes even a geyser. In Newport we have ceased fixing 3-light meters for some years; and whenever we have occasion to change one, a larger is always substituted.

LIGHTING.

I am convinced that there is room for more business in gas lighting. We in the industry know full well the disadvantages of electric light as against gas light; but have we done enough in the past to educate the consumer? Maintenance schemes (whether free or not) with monthly or quarterly inspection, together with the great improvements in lighting burners, and the supply of fireproof globes, have given us good weapons against competition. Realizing the disadvantages of electric light, we should be able to regain lost confidence, and create new business in the field of lighting. Our chief trouble is the sale of cheap and shoddy burners and fittings, third-rate mantles, and cheap glass globes. If we are to regain the lighting load, we must sell the best goods at the lowest possible prices; in fact, we must be prepared to sacrifice profit to regain lost business. In Newport we have adopted this principle, and it has been a great success.

Some undertakings may not think it worth while to bother about the lighting load; but however gas is used, whether for lighting, heating, cooking, or power, the fact that it is being employed constitutes an advertisement, and every opportunity should be taken to recommend and extend its uses. We have substituted gas lighting for electric in many shops, as well as in private residences; while in many instances where we have found householders adopting electricity, we have persuaded them to retain the gas fixtures, with the result that, after a few months' use of electricity, they have reverted to gas.

The old complaint of choked gauzes, which cause ineffective lighting, is not evident in the newer types of burner, and the slotted regulator is a great improvement on the old pattern, which was so difficult to regulate. I should like to see still further improvements in burner construction, together with the more extended use of fireproof globes. Those of you who read the paper by Mr. J. H. Canning before the Institution of Gas Engineers at their annual meeting in June last year (see "JOURNAL" for June 22, 1927) will know that all fittings, &c., are tested and stamped before leaving our works.

COOKERS.

With the older type of cooker, complaints generally received are of the gas "popping back," or that it smells while in use. The first trouble may be caused by the injector nipple becoming choked with grease or rust; and I have found on many occasions that the fitter will poke at the nipple, clear the obstruction, and leave it—as he thinks—all right. It functions correctly for a day or two, and then is just as bad as ever. It is always advisable to disconnect the downrod to the oven supply, and clean that out thoroughly, and also to remove the cap from the nipple bar, and clean that out, removing all iron rust, dust, and flakes. In many cooker downrods there will be much corrosion. As regards the complaint of smell when in use, this is due to the gas stream being broken up by a distorted injector; and slight escapes occur at the air chamber in consequence. This fault can be detected by allowing the burner to light-back, and watching the lighted gas stream. The chief danger—and one often found with old-type cookers—is that of the oven burners dying out. This is due to insufficient oven ventilation, caused by the roof space between the outer and inner cast-iron crown plates being choked by grease, or by the flue pipe being choked with corrosion or soot (if it goes into a chimney).

The new type of non-corrodible flue pipe with a **T**-end will help to remove this danger in future. Then again, a complaint "that the oven does not heat as it used to do" may mean that the drip tin has become worn out, and has been thrown away, and the oven used without one. Because of this, an increased volume of cold air is drawn into the oven, with a consequent lowering of the temperature. This results in heavier gas bills.

In a recent article in the Technical Press, Mr. A. V. Bishop discussed the position of the griller on the hotplate. He suggested that it would be an advantage if the grilling chamber was positioned at one side of the hotplate, and enclosed in such a manner that boiling food could not spill on the grill plates or penetrate into the chamber. This certainly would make for cleanliness. With the usual arrangement, the griller is left open—often in the middle of the hotplate—and is at the mercy of all kinds of dirt from the bottom of vessels and of spilled liquids, &c. This is a matter of design, but I certainly think the griller plates should be protected.

KEEP THE COOKER LEVEL.

All cookers should be fixed level. It is a remarkable fact that some fitters never consider how a gas oven functions, or

how a cooker which is not level will act on the food cooked. Packing-up the legs is not satisfactory, for it tends to increase the space between the drip tin and the bottom of the oven, thus allowing more cold air to enter the latter than is intended. If a solid base-plate fitted with short adjustable legs were provided, levelling-up would be simple, and—more important—the oven efficiency would not be effected. The cost of this plate ought not to be great, as it could be standardized, and therefore turned out in bulk. As regards modern cookers with stands, the latter could easily be made adjustable by means of a screw device fitted on the legs. It is important to see that the drip tin used is the correct one for each particular cooker; for if it is too small, the air intake will be excessive.

For the past year or so all the makers have made a step forward in cooker construction. If, however, progress is to continue, they have further alterations to consider. First, stainless steel cornice and door fitments; secondly, enclosed but adequately ventilated grilling space on the hotplate; thirdly, if section bars are used, they should be perfectly straight; fourthly, the instruction card sent out should be clearly marked as follows: "When the oven is lighted from cold, the door must be left open for a few moments to allow water vapour to escape, otherwise the shelves, gates, and inner cast-iron dome will rust." The taps on modern cookers have, by working loose, caused many complaints.

GAS BOILERS.

No modern kitchen is complete without a gas wash-boiler, and the improvements recently introduced have reduced complaints considerably. Complaints of "smell" may be due to the flue pipe being clogged by corrosion, or the burner being choked with condensate deposit. With asbestone flue-pipe, the first complaint will not occur; and if, when the boiler is lighted, care is taken to turn the gas, not full on, but only a little, so as to take off the chill, condensation will not be heavy, and the burner will remain clean. Again, rustless iron pans are more durable than tinned copper, and loose wooden lids are more serviceable than hinged metal ones.

GEYSERS.

Much has been written, and many lectures have been given, as to how a geyser should be fixed; but I am afraid that many who should know are not acquainted with the correct method. We still find geysers connected to a ½ in. gas supply taken off a ½ in. house supply, or fitted without a flue-pipe, and so on. Geysers must not be fitted with a gas supply pipe of less than ½ in., and the supply should be taken direct from the meter. Also, the meter must be large enough to cope with all appliances when the latter are in full use.

If the geyser base was provided with three legs, to raise it from the groove, the consumer could then clean the groove, and this would further reduce complaints. Our greatest trouble is rust forming at the iron socket between flow pipe and circulator; if a brass socket were sent out with the circulator, this would help matters.

Discussion.

Mr. H. S. BARTLETT (Cardiff) congratulated Mr. Hislop on his comprehensive paper. Referring to the matter of dealing with complaints of consumers, he (the speaker) said that every effort should be made to encourage consumers to keep a check on their meters. Weekly readings should be taken. With regard to size of the meters, the time had arrived when the very small meter should be dispensed with; and he was pleased to say that in Cardiff the work of substituting higher capacity meters had been carried on for some time. The author had mentioned the method of comparing the consumption of appliances with the record of those meters which appeared to be working slow. A system of testing meters *in situ* had proved beneficial, as it was found that upwards of 60 p.ct. of the meters tested failed to register when the consumption was 10 c.ft., or under, per hour. With regard to cookers, complaints concerning the spreading-flame type of hotplate burner had been received from consumers. The principal trouble appeared to be the difficulty of obtaining a low flame without extinguishing the burner; and it was found in many cases that the drilled burner was preferable. Mr. Hislop had advocated the use of wooden lids on wash-boilers; but he (the speaker) did not agree that in all cases these were suitable. Referring to lighting, Mr. Bartlett said there had been a tendency to shelve this question, especially since the advent of electric light; but, with regard to local conditions, he was pleased to say that every effort was being made to retain the lighting consumers. To this end, attractive fittings were being sold for cash or on hire-purchase terms. Excellent results had been obtained so far, and in numerous cases gas for lighting had been installed in place of electricity in the smaller dwellings and Council houses in the Cardiff area of supply.

Mr. R. MILLS (Cardiff) thanked Mr. Hislop, and, referring to cookers, said that, if a flue was necessary, it was advisable to fix a hood over the top of the cooker, as he thought that about 70 p.ct. of the gas consumed was used on the hotplate. He agreed that the groove in the stand of the geyser should be made larger, thus preventing the overflow of condensate.

Mr. T. SMITH (Cardiff) said he thought that consumers needed educating as to the use of appliances, particularly in regard to geysers. To his mind, consumers still preferred the drilled type of burner on cookers.

Mr. T. LANE (Cardiff) remarked that at a recent exhibition many consumers were impressed with the excellent gas lighting of the stand, and were surprised to find that the lights could be turned on by a switch.

Mr. H. D. HAZELL (Newport) spoke about meter indices, and agreed that some improvement should be made in the thickness of the glass. He also stated that consumers should be encouraged to check their consumption of gas in the same way that they checked other household accounts. The idea of fixing an adjustable plate on cookers was good, as fitters often had to fix cookers on uneven surfaces.

Mr. B. J. BELL (Cardiff) observed that complaints should never be of a serious nature if the undertaking concerned looked after its business properly. The testing of appliances was a very important item. Mentioning the system operating in his own district, he said that testing was carried out, with excellent results. The industry should insist on a suitable numerical meter index being adopted.

Others who took part in the discussion were Messrs. C. S. THANE, H. G. VICTORY, and W. G. BIGGINS (Newport), and T. WALROND, G. A. MOGFORD, F. H. OSBORNE, T. NOALL, T. KNIGHT, and B. SALWAY (Cardiff).

A vote of thanks, moved by Mr. R. J. WILLIAMS, and seconded by Mr. G. A. MOGFORD, was accorded to Mr. Hislop for his paper.

The meeting concluded with a vote of thanks to the Cardiff Gas Light and Coke Company for the accommodation provided.

WESTERN JUNIOR GAS ASSOCIATION.

On Nov. 3, members of the Association visited Gloucester. They were met at the Gas Office, Eastgate Street, by Mr. T. B. James, Secretary of the Gloucester Gas Company, and were then conveyed to the works, where a tour of inspection was made under the guidance of Mr. W. S. Morland, the Engineer.

Afterwards the visitors were entertained at tea by the Gloucester Gas Company.

Mr. T. B. ARMITAGE (President of the Association) proposed, and Mr. J. SPENCER (Senior Vice-President) seconded, a hearty vote of thanks to the Directors and Staff of the Gloucester Gas Company.

Mr. J. H. JONES (Chairman of the Company) and Mr. G. ALDRIDGE (Vice-Chairman) replied, cordially welcoming the members of the Western Junior Gas Association.

STEAM BOILERS AND THEIR AUXILIARIES.

By R. J. KIRKCALDY, of Gloucester.

[EXTRACT.]

To-day conditions are imposing upon us the necessity for efficiency and economy in every phase of industrial activity, and not the least important is the economical generation of steam, whether it be effected by the saving of fuel or by the working of boiler plants at their highest efficiency.

In gas-works practice steam generation is an important factor; but in the majority of works it occupies a place of secondary importance, and the over-all efficiency is usually about 50 to 60 p.ct., though in some cases it may rise to 70 p.ct. The latter figure, however, is exceptional.

As long as there is plenty of steam available at the required pressure, no great attempt is ever made to analyze the costs of production in the manner we employ in connection with the working of the retort house. If this were done, and sufficient supervision made, in some cases it would be found that the costs for steam generation could be reduced by a figure large enough to react on the cost of gas manufacture.

During recent years big attempts have been made to reduce the cost of steam raising by the installation of auxiliaries which were once regarded as "gadgets," but are now recognized as necessities. It is often assumed that substantial economies in steam raising can be effected only if large sums are spent in modernizing the existing plant. The purpose of this paper is to suggest that in many cases improved results can be obtained at comparatively little expense by the installation of one or two auxiliaries.

In view of the fact that the Lancashire boiler is in such common use, we might expect that standardization in design would have taken place, and that there would be similarity in the finished product of different makers. This, however, is far from being the case, for each maker has developed his own special ideas in details by utilizing his own experience and research, with the inevitable result that, though in external appearance all Lancashire boilers are much alike, they differ greatly in detail.

Two very common types of Lancashire boiler are those known as the angle-ring and the flange end; both being suitable for low and medium pressures up to 200 lbs. per sq. in. For working pressures above this figure, the dished-end type is generally used.

In some gas-works the conditions are such as to necessitate the use of water-tube boilers. Their advantages over the shell

type can be briefly summarized. The floor space occupied by a water-tube boiler of medium size relative to its steaming capacity is about one-third of that required by shell boilers capable of evaporating the same amount of water per hour. The water-tube boiler can be brought up to full steaming capacity from cold in a very short time; less than an hour being required for a boiler capable of evaporating 5000 gallons of water per hour, compared with several hours for a shell boiler of one-tenth this capacity. The water-tube boiler is more adaptable to the employment of mechanical stokers, and to the advantageous use of low-grade fuel.

In view of the fact that great care is taken in the construction of boilers, it seems curious that frequently but little attention is paid to their seating and housing. With a boiler plant which involves a capital expenditure of thousands of pounds, it is surely essential that good housing should be provided. All boilers should be housed in well-ventilated buildings, preferably having an open front; and the site chosen should be dry, and the earth sufficiently firm to give a good support to the concrete base, which should be of ample proportions. Many accidents have occurred in the past by the settlement of boiler foundations, which throws undue strain on the steam pipes and fittings, especially where valve bodies are of cast-iron, which is easily fractured. If the settlement be uneven, undue strain is placed on certain portions of the boiler, which may become strained by bending. This, in turn, may give rise to leakage at the seams, and consequent corrosion. As a safeguard, all boilers should be lined-off periodically, so that any settlement that may have taken place can be rectified with the least amount of trouble.

Forced and Balanced Draught.

To burn coke breeze effectively, it is essential that induced draught be used, either in the form of a steam jet or of preheated compressed air. The most common practice with Lancashire boilers using low-grade fuel is to fit one of the many types of forced draught furnace which are now on the market; but before fitting these, it is as well to ascertain the steam consumption per ton of fuel burnt, as in many cases as much as 10 p.ct. of the boiler steam is used by the steam jets. Where this form of artificial draught is employed, a heavy deposit of ash and dust accumulates in the boiler flues in a very short working period, which necessitates frequent shutting-down of the boiler; and where there is no stand-by plant available during the heavy period of winter load, great inconvenience is caused.

With many water-tube boilers burning low-grade fuels, a form of balanced draught is used. This is obtained by means of an exhausting fan situated at the chimney base, and a pressure fan for delivery to the underside of the grate. By this arrangement there is no excess pull or pressure over the fuel bed, and the tendency for the fine particles of the fuel to be carried forward is obviated to a great extent.

Superheated Steam.

In most cases where the prime movers are situated in various buildings about the works, the efficient distribution of steam is a problem which calls for very careful thought and design, especially where the steam has to be carried long distances; and where saturated steam is used, a considerable drop in pressure takes place before the steam enters the engine stop valve, no matter how efficiently the mains and services may be lagged.

In the past this trouble was overcome by having two or more boiler installations placed at convenient points for steam distribution to various power units, with resultant high maintenance and working costs and heavy capital expenditure.

In circumstances such as these, distribution can be made by means of superheated steam. By its use we can centralize our boiler plant, and thus have better control and lower maintenance and working costs. The superheating of steam has become common practice, but could with advantage be more widely adopted in gas-works than it is at the present time. It is now generally conceded that, for the effective steaming of vertical retorts, and for water gas manufacture, superheated steam is desirable.

Vote of Thanks.

Mr. A. Barrett (Frome) proposed a hearty vote of thanks to Mr. Kirkcaldy, and said that the paper would serve as a useful source of information.

Mr. A. Marsden (Bristol) seconded the vote; and Mr. Kirkcaldy's reply brought the meeting to a close.

YORKSHIRE JUNIOR GAS ASSOCIATION.

A Meeting of the Yorkshire Junior Gas Association was held at Bradford on Nov. 17, when, by courtesy of the Bradford Corporation Gas Committee and Mr. E. J. Sutcliffe (Gas Engineer and General Manager), they had the opportunity of visiting the Birkshall Works.

The party assembled at the Town Hall, and were conveyed to the works by motor, where they were received by Alderman G. Walker (Chairman of the Gas Committee), Councillor F. J. Cowie (Deputy-Chairman), Alderman Meggison, and Councillors Lennon, Watkin, Gidley, Mitchell, Highley, and Mrs. Amy Meggison (all members of the Gas Committee), Mr. Sutcliffe, Mr. Charles Wood, former Engineer and Manager, and Mr. Edward G. Gillett, Works Superintendent. The visitors were divided into sections, and were conducted over the works under the guidance of Mr. Gillett, Mr. E. Crowther (Deputy Gas Engineer), and Messrs. S. A. West, W. I. Ineson, J. Lamb, G. Griffiths, J. A. Butterfield, and F. Wadsworth.

The Birkshall Works.

The carbonizing plant consists of four benches of Woodall-Duckham vertical retorts, each bench containing twenty 5-ton retorts. Originally all the retorts were constructed of fireclay material, but during the last two years two benches (forty retorts) have been rebuilt in silica. The present output from the three working benches is 5 million c.ft. per day. One bench is kept in reserve.

The gas leaves the retort house in two streams, which pass through air and water cooled condensers and re-unite at the inlet to the exhausters, of which there are two, each of a capacity of 4 million c.ft. per day. On leaving the exhausters, the gas is again divided into two streams and passes through a "P. & A." tar extractor, tar scrubbers, and a rotary washer. The streams re-unite at the inlet to the purifiers.

Daily routine tests are made on the works, and include gas analysis, calorific value checks on the recorder, quantitative checks on the purifiers, together with readings of the combustion chamber temperatures in the retort house. It was stated that much more satisfactory results were obtained from silica than from fireclay.

The party were afterwards conducted back to the Town Hall, where tea was provided by the civic authorities.

Mr. F. Firth (Leeds) moved a vote of thanks to those responsible for the arrangements made for the Association; and this was seconded by Mr. A. Wylie (Sheffield).

Alderman G. Walker, in acknowledging the vote of thanks, said that his Committee were only too pleased to be able to welcome them to Bradford. He would like to take the opportunity of congratulating the Association upon having such a man as Mr. Packer as their President. In Bradford that gentleman's worth was realized, as apparently it had been in other fields. He was also pleased to find the members of the Association so enthusiastic in regard to their calling.

Councillor F. J. Cowie, associating himself with the remarks of Alderman Walker, said that it was essential for the gas industry to look ahead. Competition was daily growing keener; and it was only by co-operation and collaboration that success could be achieved. He believed the day was coming when both gas and electricity concerns would be joined together, so that waste heat and steam from one undertaking might be turned to the advantage of the other, and benefit not only both services, but also the public.

Presentation to Mr. J. W. Horwill.

The President (Mr. S. H. Packer) said he regretted to have to state that, owing to illness, their newly elected Secretary, Mr. R. Crowther, of Elland, was unable to be present. He (Mr. Packer) had, however, a very pleasing duty to perform. At the last meeting of the Association's Council it was decided that they could not allow their good friend, Mr. J. W. Horwill, of Bradford, to relinquish the duties of Hon. Secretary without some tangible memento of their appreciation of his services. The Association owed a great deal to Mr. Horwill. Whatever he undertook was sure to be well done; and he had left to his successor a virile Association. He had served under five presidents, four of whom were present.

Mr. C. H. Chester (Wakefield), the immediate Past-President, said that the services rendered to their Association by Mr. Horwill could not be tabulated, but they had been extremely valuable.

Mr. S. T. S. Musgrove (Sheffield) endorsed what had been said. He observed that Mr. Horwill's powers as an organizer were exceptional.

Mr. E. G. Gillett also associated himself with the previous remarks.

The President said he had much pleasure in asking Mr. Horwill to accept three pieces of silver as a mark of the esteem in which he was held by the members of their Association, and as some slight appreciation of the work he had done for them during his term of office. He was specially glad to notice that the testimonial was in such a form that Mrs. Horwill could feel she had justly a share.

Mr. Horwill, in reply, said he deeply appreciated the handsome testimonial they had presented to him. It was indeed a pleasure to know that what he had tried to do for the Association had been appreciated; and he was sure that Mrs. Horwill would value their gift. He would always look upon the gift as an outward expression of the good feeling which had existed

during his term of office. He would like to remind the members generally that he could never have hoped to gain their approbation to the extent they had shown, had it not been for the wholehearted support he had received from them, and from the officials of their Association. He would also like to take this opportunity of paying tribute to the great help given to him by Mr. Wood, the former Gas Manager and Engineer to the Bradford Gas Department—help which had been continued by Mr. Sutcliffe.

PRESIDENTIAL ADDRESS

of Mr. S. H. Packer, of Bradford.

To a large extent the future of the gas industry is in the hands of the salesman. How necessary, therefore, that the industry should take pains to choose the right men for this work, and give them the proper training for it.

Unless we, as an industry, speedily formulate a scheme for the efficient training of our prospective salesmen, we are weakening our armour for the increasing warfare against competition. "To-morrow" is a rock upon which a million ships have been sunk; and "to-morrow" in this respect may easily cause the loss of thousands of orders. We have the raw material to work upon. Keenness, enthusiasm, and ambition are present, but technique is largely absent. Intensive training is essential. Salesmanship is both a science and an art. It is not spell-binding word-play; still less is it the energetic display of artifice and cajolery to sell goods which are unnecessary to the buyer. It follows, therefore, that the salesman must be properly trained, since a science is defined as systematic and formulated knowledge, and an art as a thing in which skill may be exercised. So new is the science of salesmanship that I believe gas salesmen of many years showroom experience can study the theory of salesmanship with

THE PRESIDENT.

Mr. Sydney H. Packer was educated at the Northampton Grammar School. He joined the staff of the Northampton Gas Light Company in 1904, advancing to the position of Showrooms Manager. In 1914 he was appointed Showrooms Manager to the Bradford Corporation Gas Department. On the inception of the "B.C.G.A." Gas Salesmen's Circles, he was elected first Chairman of the West Riding of Yorkshire Circle—a position he occupied from February, 1923, until October, 1925, when he was presented with a suitably inscribed gold watch for his services. He is the present Chairman of the Publicity Club of Bradford.

beneficial results to both themselves and the undertaking they serve.

Training of salesmen may be divided into two considerations:

(1) What can be done for the salesmen already in the industry?

(2) What is the ideal training for the salesmen of the future—*i.e.*, the young men coming into the industry to-day?

With regard to the former, there is a natural tendency on the part of established salesmen to think lightly of the value of theoretical training. Actually, a salesman may learn more in six months' scientific training than he has picked up in ten years' showroom experience. Salesmanship is based no longer upon guesswork, but upon knowledge which can be systematically formulated and imparted—knowledge which has grown out of observation and experience.

Existing salesmen in the industry should be scientifically trained to sell. The lectures given by Miss Burlton under the ægis of the British Commercial Gas Association were a step in the right direction, and, even if too spasmodic to be of real lasting value, assuredly helped one to visualize the advantage of a consecutive course in salesmanship.

A salesman's job is to turn a prospective buyer into an actual buyer; and the first part of the training will consist in examining the mental states through which the mind of the customer passes in transit from being a "prospect" to becoming an actual buyer. These mental states, in the words of Mr. C. C. Knights, the eminent expert in salesmanship, are as follows: Interest is aroused; knowledge is added to; adjustment to needs; appreciation of suitability; desire to possess; consideration of cost; and decision to buy—to which must be added, in our case, service after sale.

These seven stages form a logical plan on which to build our sales. They must never be taken out of their order, and we must fully grasp the true significance of each. We may now say that salesmanship is the trained employment of our powers of persuasion and conviction to induce our customer to "decision to buy."

Knowledge of Goods.

Bad salesmanship may often be traced to ignorance of the goods being sold. No one can talk convincingly of what he knows but little about; and it is not infrequent that a customer is encountered who does know. I would like to say here how excellent a practice it is for the manufacturers of gas appliances to place at the disposal of the management of gas undertakings the services of competent lecturers who can explain to salesmen, fitters, &c., the salient points of all new inventions as they come on to the market. I am also of the opinion that visits to makers' works—if not undertaken too often—are a source of profit to the salesmen who are called upon to sell the goods.

More and more do customers look to salesmen for guidance towards a suitable selection. An expert opinion is often required, and the salesman must have the fullest information relating not only to the appliance itself, but to its use and abuse.

Included in a "knowledge of goods" is the ability to impart that knowledge in an interesting and persuasive manner. The salesman must study the art of speech; he must be ever on the alert to increase his vocabulary, to abandon the use of worn-out clichés, and to avoid as the plague blemishes of diction and phrasing. To quote Miss Burlton, only the incompetent think they know everything. The progressive salesman is always growing and learning. The more he studies his goods, the more their character charms and delights him. Gradually he grows to feel for them an enthusiastic interest which gives him the air of an expert, which, in turn, communicates itself irresistibly to his customers.

Training must be given in buying motives, among which may be mentioned: Gain of money, home-building, affection, vanity, fashion, desire for security, saving of labour, love of adornment, pride, fear of loss, desire of health, ambition, and desire to possess.

How Sales are Lost.

The all-important question of how and why sales are lost must be examined in detail, and the exact point where the sale broke down determined. As we have not succeeded, generally speaking, in educating our consumers to pay periodical visits to the showrooms, to inspect them, to see what is new in gas appliances, without the idea of purchasing something, it follows that if a customer goes out without buying, an order has been lost. Part of the training should consist in analyzing the reason for the failure to secure the order.

If the goods are deemed by the customer unsuitable, then the salesman's duty is to ascertain the precise requirements, and fill them as closely as possible. It is no use spending half-an-hour explaining an all-enamelled high-grade cooker if the customer only requires a slot type on simple hire; on the other hand, many a good hire-purchase or cash order is lost by the salesman concentrating on simple-hire goods, and not ascertaining first if the better appliances are desired.

Price Objection.

If the price is more than a customer can afford, by all means try to find something cheaper; but if the objection is that the goods are not worth the price asked, the salesman must talk "quality," and try to prove they are. The prices of many gas appliances in the showrooms seem to be exorbitant, but if the salesman talks quality, and not price, the sale can generally be effected. One of the difficulties in Bradford is that some of the outlying cities and towns supply to their consumers goods at list price *less* a good discount; and as we do not, a little tact and diplomacy are often necessary to secure the order.

Defects in the Salesman.

Often sales are lost entirely through the fault of the salesman. If a customer is not given a good selection of appliances from which to choose, the order may easily be lost; for nothing annoys a customer more than to feel that her needs are not being adequately met. Every effort must be made to get the customer's viewpoint. To do so, questions have to be asked; and they must be put in an engaging manner—not fired at the customer as if she was in a witness box. First impressions are most important; and many sales are lost at the outset by indifference, lack of imagination, and clumsiness.

A discourteous, bored, inattentive salesman is fatal to sales progress, and must be got rid of as speedily as possible. In a company this is easily done, but in a municipal undertaking, where length of service counts more than real merit, it is not

so facile of accomplishment, as in the majority of cases the offender may be an official of long service whom it is impossible to get transferred, and whose inefficiency must therefore be endured.

It rests with every man to develop the highest degree of scientific salesmanship he can command. Knowledge cannot be bought, but must be acquired by diligent, patient, and persistent effort. The present salesman who will apply himself to secure it will not only be sure of constant employment, and rise in the estimation of his employers, but will be a lamp to lighten the path of the young men who from time to time are brought into the showroom and placed on the selling staff.

Training of New Salesmen.

I now come to the second problem in the training of salesmen. All the foregoing remarks will apply to the new recruit; but in his case it will be possible to build on an entirely different foundation. The basis of training in this case should be the Education Scheme of the Institution of Gas Engineers. We want the best type of young man on the sales side; and it is imperative that he should be well educated and able to meet on an equal intellectual plane any consumer with whom he may come in contact. Matriculation standard is the ideal aim. A sound knowledge of gas supply and distribution will form an integral part of the training; and when this standard is reached, he will be well advised to specialize in some particular line such as hot water, furnaces, advertising, or window dressing, so that his services will become indispensable, and his daily work an unending source of joy to himself.

The gas salesmen's great friend and example, Mr. F. W. Goodenough, has been appointed Chairman of the Government Committee dealing with the question of salesmanship in industry; and gas salesmen will eagerly anticipate the findings of that Committee, and their probable addition to our present Education Scheme.

Status of Gas Salesmen.

Mr. F. W. Goodenough, in the September issue of the "Bulletin" of the British Commercial Gas Association, says that "We are only defeating our own ends if we employ the best engineers, the best designers, and the best craftsmen, and then fail to employ the best methods of selling the goods they turn out. It is not fair to ourselves; and if we were to continue to neglect the art of selling, we should soon make it impossible to carry out the manufacture of our goods."

The question I ask is this: How is the industry, having decided upon a definite scheme of training for its salesmen, going to attract the right type of young men to its service? Unless the status of the salesman is raised considerably, I cannot see the likelihood of the men we need most coming to us in sufficient numbers. Much better pay and far brighter prospects must be offered. The salaries generally paid to showroom assistants are a disgrace to a great industry; and a greater appreciation of their value to the industry must be shown before justice is done to a body of men who have earned their spurs by many years' hard and enthusiastic work. In some municipal undertakings skilled and well-trained salesmen are graded on a par with ordinary clerks; and in many companies the status of the salesman is very little better.

It is only human for the salesman to look upon good pay as a fair return for good service, though it must never be his sole object. There is evidence that a saner appreciation of selling is permeating the gas industry; and I plead for a general recognition of selling as an occupation, which, requiring character, brains, and culture, offers equal opportunities to those enjoyed by members of the recognized professions. I look forward to the time when in the gas industry, as in other great industries, successful selling will be the open door to managerial positions and directorships.

Advertising: What Bradford is Doing.

Bradford has for some years believed firmly in the wisdom of backing up the national and district advertising of the "B.C.G.A." by consistent and persistent advertising in the local Press. Bradford is extremely well served by its local papers; and the results have been most encouraging.

The real value of the consistent and persistent advertising we do can only be proved truly successful by the steady increase in business it helps to foster, as well as by the retention of satisfied consumers.

We recommenced simple hire of cookers on June 18, 1927, for reasons explained by my Chief (Mr. Ernest J. Sutcliffe) in his excellent address to this Association on the occasion of our annual meeting on Oct. 27—see "Journal" for Nov. 7, p. 401—and naturally it was decided to concentrate our publicity on broadcasting our change of policy to our consumers. During the following eleven weeks £76 was spent on newspaper advertising; and the average orders for cookers for this period amounted to 79 a week in excess of the previous eleven weeks. In the remaining thirty weeks of the financial year, £98 was expended in the same way, and 1443 cooker orders were received. On a cash basis, approximately 3 p.ct. would have to be added to the cost price of each cooker to cover this advertising.

Gas fires were also placed on simple hire in October, 1927; and their output has similarly increased. An expenditure of £128 in local newspapers between Oct. 16, 1927, and March 31, 1928, resulted in the previous weekly output being doubled; and here again, approximately 3 p.ct. must be added to cost.

Advertising Through Meter Inspectors.

To many consumers the meter inspector is the direct link between the gas department and the gas user; and his power to stimulate sales is unlimited. He should be given an elementary training in the art of selling, and should be kept conversant with the policy of the department and fully informed about the appliances which are offered on simple hire and hire-purchase. In Bradford a list of these with their respective rates is given to each inspector.

From time to time, distribution of literature is made by means of the meter inspectors; and any special campaign is notified through the same channel. Many orders have been definitely traced to the zeal and enthusiasm of our inspectors; and their wholehearted co-operation with our selling organization is a very good example of the happy and profitable co-ordination between the various departments which I found existed in Bradford when I was appointed to my present position in the year 1914.

Exhibitions and Cookery Lectures.

I do not know how members in other centres are affected, but Bradford would appear to be an exhibition centre. Recently two large exhibition halls have been suitably equipped for housing exhibitions on a large scale, and the two managements are vying with each other in arranging for exhibitions of all kinds. There is no doubt in my mind that an exhibition well managed and devoid of "quacks" and impostors is a very valuable "advertising agent" for a gas department, particularly if run in conjunction with a local newspaper.

The Bradford Corporation Gas Department booked suitable space in two such exhibitions last year. An island stand was taken in each case, room being allowed for the public to walk in and out of the display, and leisurely to inspect the exhibits. Apart from the value of the stand from a purely advertising point of view, good business resulted direct.

In one exhibition, which was held in the Belle Vue Barracks, under the control of Westminster Exhibitions, Ltd., and the "Bradford Telegraph and Argus," the attention of our consumers was drawn to our stand by a special leaflet containing full information of all our exhibits, and also giving particulars of a bread baking and cake making competition which we held during the period of the exhibition. Our meter inspectors distributed 80,000 leaflets, each being numbered, and a prize was given each day to the owner of a "lucky number." The consumer visiting the stand was requested to drop the "number" coupon in a special box, together with the winning number advertised by the exhibition management each day. As 1990 coupons were deposited in our box, we received a sure proof that this method of advertising had struck home. The business actually done was also excellent.

Cookery Lectures.

This old-fashioned method of propaganda is still as popular as ever; and twice during the past year a large hall has been taken in the centre of the city, when in one case a week's series, and in the other a fortnight's series, of lectures has been held. The hall was besieged with people anxious to see the demonstrations of gas cookery by qualified experts.

At each demonstration the public were welcomed by a responsible member of the Gas Department staff, and the policy of the Department was expounded, together with a brief description of the "service" which is offered to each consumer. I place the value of this "personal touch" only slightly less than that of the demonstrations themselves. Rightly used, it affords a unique opportunity for the sales staff to get into homely touch with consumers. It always pays to engage the most experienced and capable lecturer one can get.

Travelling Showroom.

Among many striking features of the recent annual conference of the "B.C.G.A.," not the least was the travelling showroom designed by Mr. H. E. Bloor, the Engineer and Manager of the York Gas Company, and referred to at length in his excellent and inspiring paper on "Local Publicity." Here is something entirely novel and of almost unlimited scope. By its means a sales attack can be made in even the remotest parts of our area of supply. Apart from being mobile, it can be equipped with suitable apparatus for each and every district, and is adaptable for pushing either cash, hire-purchase, or simple-hire goods. It may not untruthfully be described as a first-class travelling salesman.

Vote of Thanks.

Mr. C. T. B. Roper (Bradford) moved that the thanks of the Association be tendered to Mr. S. H. Packer for his address.

Mr. J. W. Carlton (Shipley), in seconding the vote, said that many of the undertakings near Bradford owed a lot to that city's undertaking for the facilities given and help readily passed on.

Mr. Packer suitably responded.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Quarterly Demands.

SIR,—It is undoubtedly the case, as you state, that householders have too many bills rendered at the same period; and it is unfortunate that the gas bill is due at the same time as local rates and income-tax.

We have had continuous meter reading combined with continuous rendering of accounts during the past three years, with undoubted advantage to both the undertaking and the consumer. There is less congestion of office work, as the work is spread evenly over the year, there is a continual inflow of money to the Department, and there is only a limited number of consumers whose accounts are rendered at the inconvenient times you mention.

The latter point has been appreciated by consumers, who have readily adapted themselves to paying the gas bill at a time that was, in former days, (say) the middle of the quarter. The point is well worth the consideration of the industry.

JAMES CAMPBELL,
Engineer and Manager.

Gas-Works,
Dunfermline,
Nov. 23, 1928.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

SPECIAL ORDERS.

The Special Orders Committee reported that no petition had been presented against the Bristol and Sheffield Gas Orders, and that there was nothing in them to which it was necessary to call attention.

HOUSE OF COMMONS.

Gas Companies' Private Bills.

The announcement that Private Bills will shortly be introduced in Parliament, to sanction the purchase by the Gas Light and Coke Company of the Grays and Tilbury gas undertaking and that of the Pinner Gas Company, has again directed attention to the need for some simpler method of carrying out such amalgamations. The Wandsworth, Wimbledon, and Epsom District Gas Company are also obliged to go through the slow and expensive machinery of a Private Bill for the purpose of consolidating their existing stock and increasing their borrowing powers. Here again, Members of Parliament are beginning to feel that in a short and crowded session such as the present one, their time ought not to be occupied, even in Committee, by the long consideration of such domestic and local details. Many Members, indeed, are writing to the President of the Board of Trade, and urging him to secure the early passage of the amending legislation which the gas industry has so long demanded.

South Metropolitan Company's Low-Temperature Plant.

Mr. WILL THORNE, M.P. (who may be regarded as the representative in Parliament of the gas workers' interests), asked the Secretary for Mines if he was aware that the South Metropolitan Gas Company intended building a low-temperature carbonization plant at their West Greenwich Works, and if he could state whether any financial assistance would be given to the Company for the erection of such plant.

Commodore KING (Secretary for Mines), in reply, stated that he had no information on the subject, apart from what had appeared in the Press.

Fuel and Power Inquiry.

Sir N. GRATTAN-DOYLE asked the President of the Board of Trade what progress had been made in instituting the Inquiry recommended by the National Fuel and Power Committee.

Mr. HERBERT WILLIAMS (Parliamentary Secretary to the Board of Trade) replied that steps were being taken to appoint a Committee to make this Inquiry, and that he hoped shortly to be able to make a further statement on the matter.

Compensation for Gas Poisoning.

Mr. S. MITCHELL asked the Home Secretary whether, seeing that gas poisoning is not included under the Workmen's Compensation Act, he would consider the question of having the Act amended so as to include gas poisoning as an industrial disease.

Sir WILLIAM JOYNSON-HICKS, in reply, said that there were various forms of poisoning by fumes or gas which were already scheduled. If, however, the inquiry referred to poisoning from gases such as carbon monoxide, which took effect very rapidly, the circumstances would, in his opinion, always be such as would constitute an injury by accident, for which compensation could be claimed under the ordinary provisions of the Act.

LEGAL INTELLIGENCE.

GAS FIRE LITIGATION.

John Wright & Eagle Range, Ltd., v. General Gas Appliances, Ltd.
Appeal Against Former Judgment.

The MASTER OF THE ROLLS and Lords JUSTICES GREER and RUSSELL, in the Court of Appeal on Monday, Nov. 19, commenced the hearing of the appeal of John Wright and Eagle Range, Ltd., of Essex Works, Aston, Birmingham, against a judgment of Mr. Justice Maugham, in the Chancery Division, in favour of General Gas Appliances, Ltd., of Corporation Road, Guide Bridge, Manchester.

John Wright and Eagle Range, Ltd., were the plaintiffs in the action. They claimed damages for alleged infringement of their patent No. 18,995, of 1913, granted to Mr. H. James Yates, of a gas fire for heating purposes. The defendants denied the infringement, alleging that the patent had been anticipated, and that it was void because of prior use, common knowledge, and insufficiency of particulars. Mr. Justice Maugham, however, held that the plaintiffs' claims were too wide to be supported, and, on the ground of insufficiency, in addition to other grounds, he held that the defendant Company was entitled to succeed; and he dismissed the action with costs.

The appeal was argued for the appellant concern by Sir DUNCAN KERLY, K.C., Mr. TREVOR WATSON, and Mr. TOOKEY; while the defendant Company was represented by Mr. WHITEHEAD, K.C., and Mr. SWAN.

Sir DUNCAN KERLY explained that the subject-matter of the litigation was a gas fire to replace a coal fire; the object of the patent being to dispose of the whole of the combustible products via the chimney of the existing grate. At the same time it was an attempt to secure a maximum of radiant efficiency with two separate exits to the chimney, each with its own particular use. The real question for the Court was that of subject-matter. He thought the Judge had decided in appellants' favour on the question of infringement. He contended that there was ample subject-matter in plaintiff Company's patent that produced something new and original and which entitled them to a decision in their favour.

A considerable portion of the technical evidence heard in the Court below was then read.

Sir DUNCAN KERLY suggested that Mr. Yates solved the vital problem of increased ventilation without diminished radiation of heat, while others were still searching for a solution. Consequently, his idea was a new one, with plenty of subject-matter in it. Indeed, it was a fresh start, with something hitherto unsuspected, when two outlets to the chimney were provided, each with its own particular job to do. In the specification, the plaintiffs had pledged themselves that they had solved the problem of complete efficiency without loss of warmth; and although, if that were not true, it would be a misdescription, nobody had made such a charge against them. Their patent had never been anticipated, argued Counsel.

Mr. WHITEHEAD, K.C., replied for respondents, and Lord Justice LAWRENCE observed that the parties were fighting, and spending thousands of pounds on, a case where it seemed that the whole matter depended on the size of the space at the rear of a gas stove.

Mr. WHITEHEAD dissented, pointing out that the case was of great importance to the parties.

His LORDSHIP: I was speaking from the commercial point of view.

The case was then adjourned.

REGISTER OF PATENTS.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Nov. 21.]

No. 32,969—33,818.

BARROW, T. M.—"Gas cleaning plant." No. 33,789.
BROMLEY, H. H.—"Incandescent gas burners." No. 33,803.
BURTON, M. G.—"Lighting gas burners." No. 32,970.
CROSSLEY, Sir K. I.—See Barrow, T. M. No. 33,789.
FLAVEL, P.—"Gas cooking ovens." No. 33,098.
GAS LIGHT AND COKE COMPANY.—"Joint-making packing." No. 33,075.
HOLM-HANSEN.—"Gas lighter." No. 33,699.
LEYH, E.—"Coke-ovens." No. 33,389.
METALLGES AKT.-GES.—"Supply of gas from a distance." No. 33,295.
PAYNE, S.—See Holm-Hansen. No. 33,699.
RADIATION, LTD.—"Racks for cooking apparatus." No. 33,085.
RADIATION, LTD.—"Taps or cocks." No. 33,508.
RADIATION, LTD.—"Gas fires." No. 33,788.
SPENCER THERMOSTAT COMPANY.—"Safety devices for gas burners." No. 33,055.
TOTZEK, F.—"Regenerative coke ovens." No. 33,390.
TOTZEK, F.—"Coke ovens." No. 33,452.
TWIGG, W. R.—See Radiation, Ltd. No. 33,085.
TWIGG, W. R.—See Radiation, Ltd. No. 33,508.
WELLS, J.—See Burton, M. G. No. 32,970.
WEST, E.—"Retorts for carbonization of coal." No. 33,792.
WEST'S GAS IMPROVEMENT COMPANY, LTD.—See West, E. No. 33,792.
YATES, H. J.—See Radiation, Ltd. No. 33,788.

MISCELLANEOUS NEWS.

INSTITUTION OF GAS ENGINEERS—EXAMINATIONS IN GAS ENGINEERING AND GAS SUPPLY, 1928.

Abstract of Examiners' Reports.

GAS ENGINEERING—ORDINARY AND HIGHER GRADE.

Following on what has been said on the subject in previous years, it is a pleasure to report that in 1928 there was a marked improvement in the drawings, diagrams, and sketches. Generally there was some weakness in the answers, or a tendency to avoid the engineering questions, such as power, foundation, and construction. It would appear that more emphasis should be given by the lecturers to this part of the syllabus, and that students should endeavour to obtain more practical experience by taking every opportunity of obtaining practical experience on the works, thereby securing a better insight into working conditions.

DIPLOMA IN GAS ENGINEERING.

As far as the written papers are concerned, the preceding paragraph is equally applicable to that portion of the Diploma Examinations. The theses generally showed marked improvement on the previous years. Of the fourteen theses presented, nine were passed for the Institution Diploma, and seven of these were awarded over 80 p.ct in the markings. Several were contributions worthy of the highest award. The subjects for the theses were well chosen, much initiative and original work were represented, and the results and conclusions were convincingly recorded.

The Oral Examination is the "acid test" of the real knowledge of the student. The Examiners were of the opinion, from the oral examination, that better efforts must be made by students to gain practical experience, by visiting and spending time on gas-works, especially where construction is taking place and plant is being dismantled for overhaul and repair. There is no doubt that officials in the gas industry will readily give every facility to students in the interests of improved technical education.

GAS SUPPLY—ORDINARY AND HIGHER GRADE.

The Examiners in Gas Supply also are able to report a real improvement in the general level of attainment of the students, particularly in the Ordinary Grade. In every year since the Education Scheme has been in operation, the Examiners in Gas Supply and their colleagues on the engineering side have called attention to the weakness in the illustration of answers by sketches. There is still room for substantial improvement in this direction. Too often sketches are obviously copies from memory of sketches in text-books, instead of being, as they should be, graphical expressions of the student's first-hand knowledge of the thing illustrated. Straightforward well-proportioned line sketches showing essentials are required—not elaborate sketches of detail which overshadow the essentials. Finally, the Examiners ask teachers to encourage their students to think for themselves. Broad principles should be dealt with by the teacher; it is not necessary for every item in the syllabus to be covered in detail.

DIPLOMA IN GAS SUPPLY.

Three candidates presented themselves for the Diploma Examination this year, but unfortunately none of them satisfied the Examiners that he had the all-round knowledge and experience that they consider necessary to justify the award. Candidates for the Diploma undoubtedly have difficulty in choosing suitable subjects for the thesis and in dealing with this subject in a way which may be called "original." The view of the Examiners is that the name "thesis" tends to encourage candidates to strain after "originality," and to overlook the importance of presenting the chosen subject in a form worthy of a Diploma candidate, and showing a first-hand knowledge of it.

CITY AND GUILDS OF LONDON INSTITUTE.—EXAMINATIONS IN MINOR COURSE SUBJECTS, 1928.

The following general report is given on the papers as a whole, and is not necessarily applicable to the work from individual schools. It is requested that the attention of teachers and others interested should be called to it.

11A.—MINOR COURSE IN GAS-WORKS PRACTICE.

It is a pleasure to be able to report that the answer papers in the above subject were much better than usual; and though sketching is still a weak point, the students show a much better knowledge of the subject. Teachers should be advised to impress upon their students the necessity of carefully reading the questions before giving the answers, as in several cases candidates lost marks by not observing carefully what was required.

11B.—MINOR COURSE IN GAS SUPPLY PRACTICE.

There does not appear to be anything special to report in connection with these examinations.

GAS FITTING.

The general standard of the answers in the written papers can only be considered fair, with a few exceptions which were very good. The chief weaknesses were, first, inability to make a clear statement; secondly, want of method in the arrangement of answers; and, lastly, poor sketching. Some candidates, having partly answered a certain question, appear to have commenced another, and then reverted to the previous one without giving any indication of the number. It was also apparent that many candidates did not read the questions carefully before answering, and some attempted to deal with more than the specified number, instead of devoting the whole time to the maximum which were to be attempted—viz., six.

From the Local Examiners' reports, it would appear that the candidates in the *viva voce* examination and practical work in Grade II. and Final showed promise, and in many cases the results were good.

Statistical Return showing Results of Institution of Gas Engineers' Examinations, 1928.

INTERNAL CANDIDATES.

Subject.	No. of Entrants.		First Class with Distinction.		First Class.		Second Class.		Failures.	
	1927.	1928.	1927.	1928.	1927.	1928.	1927.	1928.	1927.	1928.
Gas Engineering—Ordinary Grade	48	34	7	3	7	8	26	10	8	13
Gas Engineering—Higher Grade	18	38	..	..	5	3	7	18	6	17
Gas Supply—Ordinary Grade	43	46	2	6	14	12	14	18	13	10
Higher Grade	9	15	..	..	1	..	4	4	4	11
Totals	118	133	9	9	27	23	51	50	31	51

EXTERNAL CANDIDATES.

Subject.	No. of Entrants.		First Class with Distinction.		First Class.		Second Class.		Failures.		Withdrawals.
	1927.	1928.	1927.	1928.	1927.	1928.	1927.	1928.	1927.	1928.	
Gas Engineering—Ordinary Grade.	40	35	..	2	6	10	26	17	8	6	..
Gas Engineering—Higher Grade	27	25	2	..	9	3	9	14	5	8	2
Diploma	8	18	1	2	..	1	2	4	5	7	4
Gas Supply—Ordinary Grade.	18	35	1	..	8	12	5	13	4	10	..
Gas Supply—Higher Grade	7	3	..	..	3	1	..	2	4	..	..
Diploma	..	3	..	..	..	..	..	..	..	3	..
Totals	100	119	4	4	26	27	42	50	26	34	6

Examinations of the City and Guilds of London Institute in Gas Subjects.

The results of these Examinations are as follows:

Minor Course in Gas-Works Practice.

Entries.	1st Class.	2nd Class.	Fail.
16	7	3	6

Minor Course in Gas Supply Practice.

71	2	26	43

Gas Fitting, Grade I.

302	Passed, 273	Failed, 29	..

Gas Fitting, Grade II.

Entries.	1st Class.	2nd Class.	Fail.
136	45	36	55

Gas Fitting, Final Grade.

42	19	12	11

INSTITUTION OF GAS ENGINEERS.

EDUCATION SCHEME—EXAMINATIONS, 1928.

FINAL LIST OF SUCCESSES.

(Previous lists were published in the "JOURNAL" for Sept. 5 and Oct. 24.)

CARDIFF TECHNICAL COLLEGE.

Name.	Class.	Ancillary Subjects Taken.
Lane, W. T.	2nd	Inorganic Chemistry, Building Maths. and Geometry, Engineering Science.
Mogford, G. A.	2nd	Inorganic Chemistry, Organic Chemistry, Engineering Science.

In addition to completing his course for the Ordinary Grade in Gas Engineering, Mr. Lane has taken Ordinary Grade Gas Supply as a single subject, to qualify in due course for the Examination for the Diploma in Gas Engineering. He obtained a First Class with Distinction. He will receive a letter from the Chairman of the Gas Education Committee, certifying his success.

SUGGESTED SUBJECTS FOR THESES IN GAS ENGINEERING.

In order to give guidance to candidates for the Diploma in Gas Engineering who may be in doubt as to the choice of a subject for their thesis, the Examiners have compiled the following list of subjects from which a choice may be made:

1. Methods for reducing the loss of make during scurfing, especially in vertical retorts.
2. Improved results to be obtained by incorporating in carburetted water gas plants the modern improvements now available.
3. Coke grading and coke grading plants, coke cleaning and drying, and the possibility of creating a greatly increased demand for graded coke for domestic heating stoves.
4. The valuation of coke for gas-works purposes.
5. The complete recovery of waste heat on gas-works, including exhaust steam.

(The above were published in the "JOURNAL" for Sept. 21, 1927.) To these have now been added:

6. The effects of blending coal upon the quality of the coke produced.
7. The relationship between the thickness of the charge of coal in a horizontal retort and the quantity and quality of the products of carbonization.
8. The effect of different methods of cooling and handling upon coke.
9. The effects of different methods of carbonization upon coke.
10. Investigation of the quantity and quality of tar obtained at various stages in the process of condensing and scrubbing.
11. The relationship between dehydration of gas and naphthalene deposition.
12. The relationship between results obtained from small and large scale tests of coal.
13. The relationship between the calorific value, volatile content, and gas-making property of coal.
14. Tar emulsions, their formation and separation.
15. Retort house control.
16. Investigation of various sources of heat losses in retort settings.

It is to be clearly understood that the publication of this list (which merely indicates the sort of subject that is suitable) is not intended to fetter in any way the free choice of subject by the candidate. The Committee would prefer that each candidate should choose his own subject. Any such which falls naturally within the wide limits of "some aspect or point of gas-works construction or gas manufacture" (clause 5 of the regulations) will be acceptable. The Committee stipulates only that the thesis shall show original thought, observation, and deduction—not necessarily original research work—and not simply a summary of information and results which have been altogether taken, or can be obtained, from text-books.

The theses of all candidates for the Diploma in either Gas Engineering or Gas Supply must reach the Organizing Secretary at the latest by March 27 next.

Applications to sit as external students in 1929 in all grades in Gas Engineering and Gas Supply must be sent in at the latest by Feb. 27.

Any student desiring advice as to his course should apply to the Secretary of the District Education Committee covering the area in which he resides.

ORIENTAL GAS COMPANY, LTD.

ANNUAL GENERAL MEETING.

The Annual General Meeting of the Company was held at the London Offices, Finsbury House, Blomfield Street, E.C., on Wednesday, Nov. 21—Mr. STANLEY H. JONES, M.Inst.C.E. (the Chairman), presiding.

The SECRETARY (Mr. S. Rainer) read the notice convening the meeting and the report of the Auditors; and the report of the Directors and the statement of accounts for the financial year ended June 30 last were taken as read.

The CHAIRMAN: The period covered by the accounts we present to you has been, I am glad to say, one of uneventful but steady progress in the Company's business in regard to our principal commodity—namely, gas sale—in spite of the fact that the returns from residual products have not been so satisfactory, owing to the depressed market price of coke. However, reviewing the accounts as a whole, I think you will agree that the result of the year's working of the Company's undertaking is highly satisfactory.

THE COMPANY'S RECORD.

Now, I should like to think that I am addressing a wider audience than the shareholders in this Company. I allude to our Indian friends in Calcutta, who have in various directions indicated their interest in the operations of the Company. When these gentlemen look back on the long period—over seventy years—during which the Company has faithfully carried out its obligations to the City of Calcutta, I am constrained to believe that they will express the same feeling of satisfaction which you, gentlemen, and we conscientiously hold on this side. In its public service to Calcutta, the Oriental Gas Company's record is, I submit, a very creditable one. We have never advertised the fact. To our Indian friends, we would say: "Si monumentum requiris, circumspice." By night as well as by day the Company is rendering utility service to thousands of our Indian friends; and it is the constant aim and endeavour of the Directors to afford the consumers in Calcutta the most efficient and economical supply of gas possible in the circumstances in which the Company is placed. With this object in view, the works have been equipped with up-to-date plant and appliances for the manufacture and distribution of gas, and everything is being done to cheapen the cost of a commodity now so necessary in everyday life.

OBSOLETE CONTRACT CONDITIONS.

Unfortunately, the efforts of the Directors and Manager in this direction are severely hampered by the provisions of an old contract between the Corporation and the Company entered into for the supply of gas to the public lamps, which is now obsolete, but has still some three years to run. Under this agreement, the Company is compelled to supply unmixed coal gas of an illuminating power of 14 candles. As is well known, gas undertakings, with few exceptions, all over the world nowadays supplement their coal gas with a proportion of water gas which is manufactured from coke and superheated steam, and when required enriched with gas oil. The importance of this is twofold. It is a convenient and quick method of increasing the manufacture in face of an emergency, and it enables the management to control the amount of coke thrown upon the market and to economize the use of coal when coke is plentiful and cheap. It is surely obvious that anything which tends to improve and cheapen the production of gas is to the benefit of the purchaser and user of it, while whatever hampers and restricts the process inevitably increases the cost and enures to the detriment of the consumers.

GREATER IMPORTANCE OF CALORIFIC VALUE.

People in this country are aware that it is the heating value of the gas, and not its illuminating power, which is important to the consumer, whether the gas is used for lighting or heating, because the present-day lighting burner is fitted with a mantle which becomes highly luminous when heated. But this fact is not so well known in Calcutta, and some people there, who are not familiar with what is becoming universal practice in Western countries, feel nervous when change is suggested lest the Company should gain some undue advantage over the public by its means. Nevertheless, the high standard of luminosity which the Company is bound under penalty to maintain is of no value whatever to anybody, but it is costly to produce and hampers the development of the business. Our Manager has demonstrated to representatives of the Corporation that gas supplied, not on the present high illuminating standard, but on a heat basis only, will afford an equally satisfactory light in the public and other lamps as the gas at present provided, and will remove an obstacle in the way of a more efficient and useful supply to all our customers, and in the not distant future will enable the Directors to reduce the price of gas. Perhaps I may venture to remark that, in hesitating to agree to the proposal of the Directors that a heating standard shall be substituted for the existing lighting standard, and that the Company shall be set at liberty to manufacture the kind of gas which for the time being most satisfactorily meets the needs of its customers, our Indian friends, albeit with the best intentions in the world, are none the less literally "standing in their own light." I should mention that there is in Calcutta a body, I understand officially appointed, and known as the Smoke Nuisances Commission, who are very insistent that the use of gas and smokeless fuel should be extended so as to help remove one of the troubles in Calcutta—namely, smoke pollution of the atmosphere—and I am hopeful that in the interests of all concerned their efforts will be successful.

ITEMS OF THE ACCOUNTS.

I will now deal with the principal items of the accounts, contrasting them with those of the previous year. Starting with the capital account, there has been no further debit on the expenditure side, but a small credit of £250 arising from the sale of some old plant. Then turning to the revenue account, on the expenditure side, coals cost less by some £3300—the effect of new lower priced contracts. Salaries are some £240 more, due to the automatic increases under our officers' agreements. Purification cost slightly more, and repairs on works about £1500 less. In the distribution department salaries and wages cost some £250 more. Mains and services cost nearly £2000 more, due to a larger outlay on mains and services being necessary to meet the needs of our growing business. Meters cost a little over £500 more, and stoves and fittings about £800 more. These increases are due to the same cause as the increase in our mains expenditure. Public lamps costs show a gratifying reduction of nearly £700; and rents, rates, and taxes are also lower by over

£800. Under management, Directors' and Auditors' fees remain as before. Salaries in London and Calcutta show a small increase of £234; and stationery and general charges are about £232 more. Bad debs are £50 more. Law charges are £970 less. You may remember that last year I told you we had to incur rather heavy legal costs in proceedings with the Howrah Municipality. Superannuations and pensions are slightly higher; but passages are £125 less. You will observe that we have charged the revenue account with a sum of £5000 for the credit of renewals suspense account. In explanation, I may say that we have done this in view of the necessity, in the not far distant future, of undertaking the renewal of the lifts of two old gasholders, one at our Sealdah Works and the other at our Howrah Works. You will remember that we drew heavily on the renewals suspense fund seven or eight years ago, and we think it advisable to build up this fund again. On the receipts side of the revenue account, gas rental is more by £6450. We sold 564 million c.ft. of gas, as compared with 537 million c.ft. last year. Meter and stove rentals are higher by £270. Residual products show a fall of £3150, due, as I have said, to the depressed state of the coke market. Finally, the balance of profit is £26,048, as compared with £24,585 a year ago.

NET REVENUE ACCOUNT AND BALANCE-SHEET.

Turning to the net revenue account, you will see that the bank interest is £1860, as compared with £2480. The interest on our investments remains as before at £574. Profit on exchange is £6439, as compared with £6112. The balance available for dividend is £68,092. An interim dividend was paid in May last of 3½ p.ct., less tax, and we now recommend a final dividend of 4½ p.ct., less tax. The reserve fund remains as before, and also the depreciation account. The renewals suspense account is increased to £17,000; while the exchange equalization account is as last year. Turning to the statement of coals, we carbonized 45,476 tons, as compared with 48,068 tons last year—the result of a higher make of gas per ton. As regards the statement of residual products, we sold 20,651 tons of coke, as compared with 21,543 last year; 1336 tons of breeze, as compared with 3233 tons; 586,839 gallons of tar, as compared with 477,546 gallons; and 222 tons of sulphate, as compared with 288 tons. On the debit side of the balance-sheet, amounts due for coal, stores, &c., are £14,328, as compared with £15,169. The loan from the bank is £31,035, as compared with £40,430—a satisfactory reduction of £9395. On the credit side, cash at the bank is £3451, as compared with £4499. Our investments remain as before; while stores are £30,212, as compared with £31,959. Amounts due to the Company are £7622, as compared with £2725. I understand this difference was due mainly to a periodical payment due from the Calcutta Corporation for public lighting having been delayed. I would mention that the capital expended per million c.ft. of gas sold has been reduced by £39.

A SATISFACTORY STATEMENT.

Our Manager reports that our works are in good and serviceable condition. The sale of gas shows 5 p.ct. increase, and some 1200 gas-consuming appliances have been fitted during the year. Our relations with the public bodies have been quite satisfactory. To deal with the increasing demand for gas it is necessary, in order to give the higher pressure now required in outlying areas, to instal a small district holder, and somewhat re-arrange our subsidiary plant at the works; and this work is in hand. I cannot conclude my remarks without a word of praise for our staff at home and abroad. This will be a subject of a special motion; but as your Chairman I feel I must add my testimony to the excellent work done by our General Manager and his staff in India in carrying on far away, and somewhat cut-off from association with Western ideas, our undertaking so successfully year by year, and enabling your Directors to present to you such satisfactory accounts. I must also refer to our Secretary and his small staff, and thank them for much work well done. I have now to move the adoption of the report and accounts.

Mr. BERTRAM W. ELLIS, Assoc.M.Inst.C.E., seconded the motion; and it was unanimously adopted without discussion.

DIVIDEND AND RE-ELECTIONS.

On the proposition of Mr. HUGH H. MACLEOD, seconded by Mr. W. G. BRADSHAW, C.B.E., it was resolved:

> That a dividend of 8 p.ct., less income-tax, be declared for the twelve months ended June 30, 1928, and that the same be paid to the proprietors on Nov. 22, less 3½ p.ct. paid on account on May 31 last.

The CHAIRMAN proposed the re-election as Directors of Messrs. H. H. Macleod and W. G. Bradshaw. He said that both were towers of strength to the Board—one of them helping materially in the matter of coal supplies, and the other in all questions relating to finance.

Mr. B. M. GILL seconded this, and it was agreed to.

The Auditors (Messrs. S. W. Savage and F. J. Bradfield) were re-appointed, on the motion of Mr. FLETCHER, seconded by Mr. BRADSHAW.

VOTES OF THANKS.

Mr. ELLIS, proposing a hearty vote of thanks to the General Manager, Secretary, and staffs in Calcutta and London, for their work during the year under review, remarked that this was always a very pleasant duty. Mr. Snelgrove, the General Manager and Engineer, had been home this year, and his leave had much improved his health. There had been, he was glad to say, no serious epidemics in Calcutta during the past twelve months; but at the same time, of course, the staff had a good deal to contend with in the matter of climate. During Mr. Snelgrove's absence, Mr. Garsed deputized, and did it in a most efficient manner. For this they owed him thanks. As would have been noticed from the accounts and the Chairman's address, they had been busy laying new mains, and had installed a quantity of apparatus. This had been done under the control of Messrs. Bacon and Morrison. The Works Manager, Mr. Smith, had also had a lot to do in the matter of maintenance and development of the works, and all the other members of the staff had ably assisted in their respective capacities. One great point about their staff when they came home on leave was the unselfish way in which they placed themselves at the disposal of the Directors, and travelled from place to place to make themselves acquainted with the developments in working which had come about during their absence abroad. This was great evidence of their loyalty and enthusiasm for their work. As for Mr. Rainer and the London staff, he could add nothing to what he had said about them in previous years. They had maintained their own high standard.

Mr. MACLEOD seconded the vote, which was heartily passed.

Mr. RAINER, responding on behalf of Mr. Snelgrove and the staffs in Calcutta and London, remarked that the results which had been placed before the meeting were proof of the fact that, in spite of not altogether ideal climatic conditions, those in Calcutta had done the work allotted to them to the very best of their ability.

Mr. F. J. BRADFIELD proposed a vote of thanks to the Chairman and Directors. The small attendance was, he said, clear evidence of the satisfaction of the shareholders. He had examined the figures thoroughly subsequent to the audit, and had for them nothing but praise. The chief figure was the reduction of capital. This, combined with the 5 p.ct. increase in sales, and the putting aside of £5000 to suspense (showing that all expenditure during the year had been paid out of revenue), was remarkable. He was sure many other companies would wish they could do the same thing.

Mr. FLETCHER seconded the vote, which was unanimously passed, and acknowledged by the CHAIRMAN, who said the Directors were glad to be supported by the shareholders in their policy of declaring steady dividends year by year.

IPSWICH TO PURCHASE THE WOODBRIDGE UNDERTAKING.

Application for Board of Trade Order.

The shareholders of the Ipswich Gas Company, at an extraordinary meeting on Wednesday, Nov. 21, unanimously approved of an application to the Board of Trade for a Special Order authorizing the purchase of the Woodbridge Gas Light and Coke Company; the extension of the Company's limits in the Woodbridge area; and the charging of differential prices. The chair was taken by Mr. P. W. Cobbold, who was supported by Mr. Hugh Turner, Mr. Frederic Corder, and Mr. G. H. Hewetson (Directors), Mr. G. A. Mallett (Secretary), and Mr. Frank Prentice (Engineer).

Mr. MALLETT explained that the limits of the Company for the supply of gas would extend to, and include, in addition to the existing limits, the Urban District of Woodbridge, and the parishes of Bredfield, Brightwell, Bromeswell, Bucklesham, Foxhall, Great Bealings, Hacheston, Kesgrave, Levington, Little Bealings, Martlesham, Melton, Pettistree, Playford, Ufford, and Wickham Market. It would be understood that the Company could not supply gas to Woodbridge and the outlying places at the same price as at Ipswich, and so they applied for differential prices. The Board of Trade had given what the Directors considered satisfactory prices under Clause 9. Near the borough there would be one price, further out another, and still further out a third.

The CHAIRMAN, having apologized for the absence of Mr. Henry Woodall, the Chairman of the Company, said that the Board of Directors had been considering for some time the acquisition of the Woodbridge Company, but what really brought the matter to a crux was the very large amount of building which had been going on for the last few years between Ipswich and Woodbridge; and the Board knew that the occupiers of these houses would want gas. Mr. Mallett had read out a long list of outside parishes to be covered by the Order, and in due course they hoped that the demand for gas would justify them in laying a main to them; but for the moment they were chiefly concerned in supplying gas to the consumers who were at present supplied from Woodbridge. Woodbridge would gain by obtaining gas at a reduced price, constant pressure, and constant quality. As far as the Ipswich consumers were concerned, the fact that there had been no opposition from any quarter was clearly sufficient proof that their position would not be prejudiced in any way. The Directors had every confidence that, with the additional turnover and the additional profits, they would in the future be able to reduce the price in Ipswich, and increase the dividends to their shareholders. They entered into the agreement with the Woodbridge Directors in July last, paying £15 for each £10 share, and they took over the works in September. They had commenced the laying of a 12-in. main from Ipswich, and already they were connected with some sixty consumers on the way, and they had applications altogether from about 200. It was anticipated that they would be supplying Ipswich gas to Woodbridge by the end of next year.

Mr. W. J. NAUNTON seconded the resolution. As a Director of the Woodbridge Gas Company, he thought the purchase was a move in the right direction.

The resolution was carried unanimously, and, in conclusion, a vote of thanks was accorded to Mr. Cobbold for taking the chair.

Gas Main Extensions at Rhyl.—It was reported to the Rhyl Council, at their meeting on Nov. 12, that extensive work is contemplated in connection with the gas undertaking, consequent upon the rapid increase in building on the outskirts of the town. It has been decided to ask the Ministry of Health for sanction to borrow £2560 for a new 8-in. main. Machinery is also to be installed in connection with the new water gas plant. A scheme for the reconstruction of the existing works is also being prepared.

COOKERY DEMONSTRATIONS AT SMETHWICK.

Award of Prizes in Cake Making Competition.

Cookery demonstrations have been held with great success throughout the month of November in various parts of Smethwick. In conjunction with the demonstrations, a Cake Making Competition was arranged, and keen interest was displayed. The entries, numbering 169, were of a particularly high standard. Miss Olive Humphries (Cordon Bleu, N.T.S.C.), the cookery demonstrator, judged the cakes; and three prizes, consisting of a gas cooker for the first, a gas fire for the second, and a gas iron for the third, were awarded.

The Chairman of the Gas Committee, Alderman A. M. Willicts, J.P., made the presentations on Tuesday, Nov. 28, at Trinity Church Hall, where the last of the series of cookery demonstrations was held. Miss Humphries explained the points taken into consideration when judging the cakes, and her explanation was very much appreciated by the audience.

The Gas Committee took the opportunity of presenting publicly the merit awards made to apprentice gasfitters for successes at the technical training classes held throughout last session, organized by the City of Birmingham Gas Department. The Chairman of the Gas Committee informed the students how very pleased his Committee were with the results obtained.

The prizes were also presented to the successful competitors in the Fairy Gas Competition—notably Miss Anna Ray, who gained first prize in the Intermediate Section from among 7000 competitors.

The Chairman of the Gas Committee was supported by the Mayoress of Smethwick and Mr. Ernest Hardiker, F.C.S., the Gas Engineer and Manager.

COAL TRADE REPORTS.

From Our Own Correspondents.

NORTH-EAST COAST.

Relying as they do almost entirely upon regular and frequent arrivals of boats, the weather has naturally upset all calculations during the past week. Idle time has been experienced by most, and this has had a weakening effect upon the tone of prompt markets. Taking the longer view, however, prospects are regarded hopefully. Inquiry for next year is on a fair scale, and some good sales are reported to have been made.

Northumberland steams remain firm, and are doing good trade mainly on home account, though smalls are rather a slow market. Best screened sorts quote 14s. to 14s. 3d. f.o.b. Gas coals are rather more active. Wear Specials ask 15s. to 15s. 3d., best qualities 14s. 9d., and others 13s. to 13s. 6d. Coking sorts are quiet, at 13s. to 13s. 6d. Unscreened bunkers vary considerably. Best qualities are firm for forward up to 14s. 3d., but this can be discounted for prompt, owing to the present tonnage position. Other qualities are weak at 13s.

Shortage of boats and high freights are operating against gas coke trade. Stocks are inclined to accumulate, and 19s. 6d. f.o.b. can be shaded for prompt shipment.

YORKSHIRE AND LANCASHIRE.

Gas coals are moving slowly under contract, with indications that the anticipated advances in this direction will not be maintained.

The general industrial section of the trade is chiefly concerned with the renewals of contracts. Washed fuels are playing a prominent part, with values somewhat similar to those of last year.

The export trade remains unaltered.

There has been a decline in the demand for house coal during the past week. Secondary qualities of a bagging nature are in chief request. The better grade fuels have declined. Deliveries are to be obtained within reasonable time.

The following are the Humber bunker and export prices, f.o.b. usual shipping ports:

South Yorkshire—Hards, Association, bunkers 19s. 3d. to 19s. 6d., export 16s. to 16s. 6d.; screened gas coal, export 15s. 6d. to 16s. 6d.; washed trebles, 15s. 6d. to 16s.; washed doubles, bunkers 17s. to 17s. 3d., export 15s. to 15s. 3d.; washed singles, export 14s. to 14s. 3d.; washed smalls, 13s. 9d. and 10s. 9d. to 11s.; rough slack, bunkers 12s. 6d. to 13s., export 8s. 6d. to 9s.; smithy peas, export 16s. 6d. to 17s. 6d. per ton.

West Yorkshire—Hartley's (f.o.b. Goole), bunkers 16s. 3d. to 17s. 3d., export 14s. to 15s.; screened gas coal, export 14s. to 15s.; washed trebles, export 15s. 6d. to 16s.; washed doubles, 14s. to 14s. 6d.; washed singles, 13s. to 13s. 3d.; washed smalls, bunkers 13s. 3d., export 10s. to 10s. 6d.; unwashed trebles, 14s. 6d. to 15s.; unwashed doubles, 12s. to 12s. 6d.; rough slack, 8s. 9d. to 9s. 3d.; coking smalls, 8s. 6d. to 9s. 6d. per ton

Derbyshire and Nottinghamshire—Top hards, bunkers 19s. 3d. to 19s. 6d., export 15s. 6d. to 16s. 6d.; cobbles, export 15s. 6d. to 16s.; washed trebles, 15s. 6d. to 16s.; washed doubles, 13s. 6d. to 14s. 3d.; washed singles, 13s. to 13s. 6d.; washed smalls, bunkers 13s. 6d. to 13s. 9d., export 10s. 6d.; unwashed doubles, export 12s. to 13s.; rough slack, bunkers 12s. 6d. to 13s., export 8s. 6d. to 9s. per ton.

Yorkshire, Derbyshire, and Nottinghamshire—Screened steam coal, bunkers 17s. to 18s., export 13s.; gas coke, export 21s. to 22s. 6d.; furnace coke, export 19s. to 19s. 6d.; washed steam (Goole, West Yorks.), bunkers 16s. to 16s. 6d.; (Hull, West Yorks.) 17s. to 17s. 3d., (Hull, South Yorks.) 17s. 3d., export 14s. 6d. to 15s. per ton.

MIDLANDS.

Markets remain very dull in all departments. At some pits output has been further restricted. Not only are slacks and smalls offered in spot lots at prices far below production cost, but inferior grade coals of larger size, such as are applicable either to industrial use or to the yard trade, have been coming on the market at cut rates in order to clear.

Generally speaking, there is no difficulty in getting quick delivery of high-grade domestic fuel. Demand is only very moderate. A rather brisker call for "D.S." nuts and slacks for factory consumption is reported from some of the metal-working districts. There is a little more activity in the fuelling of public institutions with the advance of the season, but the continued mildness of the weather delays anything like general revival. Annealing coal has been sold on an expanding scale.

The market is in some perplexity as to the probable effect of the relief in transport costs which is about to materialize. As collieries do not include carriage in their sales, it is plain they can only participate in the relief by raising their prices. But what are the possibilities of this, it may be asked, in view of keen competition in markets which are over-supplied? Efforts to put prices on an economic level have been defeated this fall by the excess of supply over demand. How will the Government grant for easing railway rates affect this? At the time of writing there is no symptom of any stiffening of pithead prices.

Coke is obtainable at ovens on the terms which have hitherto applied, and weakness characterizes the rates for coal.

TRADE NOTES.

Treatment of Water Gas Tar Emulsions.

The Semet-Solvay Engineering Corporation have recently produced a pamphlet (No. 357) dealing with an economical method of treating water gas tar emulsions. The "R. S. De-Emulsifier" is made in three sizes to fit any local requirement.

New Holder for Cork.

The Cork Gas Consumers' Company have recently placed with Messrs. Broadhead Constructions, Ltd., of 4, Chapel Walks, Manchester, an order for installation, in an existing tank of 150 ft. diameter, of a three-lift spiral-guided gasholder, of approximately 1,400,000 c.ft. capacity, together with the demolition and removal of the existing holder.

"W-D" Installation for Otley.

The Directors of the Otley Gas Company, on the recommendation of their Manager, Mr. E. J. Holliday, have placed an order with the Woodall-Duckham Vertical Retort and Oven Construction Company, Ltd., for an installation of "W-D" continuous vertical retorts. The plant will consist of eight retorts with a total carbonizing capacity of 42 tons per day, and will be complete with a retort house (large enough for twelve retorts), coal elevator, steam driven lift, waste-heat boiler, coke screens and storage hoppers, and all the necessary concrete foundations.

Welsbach Heating Appliances.

The success of the Kern "Handiheater" has led the Welsbach Light Company, Ltd., to produce a "Handiheater De Luxe" with 5 and 7 tubes. This model is in cast iron, has ornamental side panels, and embraces all the selling points and advantages found in the original design. The general outline is distinctly attractive, and will command the consideration of discriminating purchasers. Welsbach Kern radiators will again be prominent in the coming season. All last year's models will be available. The "Kirby" and "I.P." models, fitted respectively with 5 and 10 tubes, are the most favoured lines. They are supplied in various coloured indestructible enamels, and also in dead art black. The two patterns are fitted with arrangements for heating water, and the "I.P." may be had with separate boiling ring. The "Kirby" is suitable for rooms 12 ft. by 12 ft., and the "I.P." for rooms 20 ft. by 20 ft. An addition to the large range of Welsbach gas fires is the "Venus" 5-radiant, which meets the demand for small, cheap, long-service portable gas fires. It has a cast bow front with cast top, is fitted with fireclay back, and side panels of solid corder, top heating outlet, flue outlet, and guard and toaster. With each stove, a box of 6 radiants is supplied.

CONTRACTS OPEN.

General Stores (Oils, Paints, Lead Pipe, Sulphuric Acid, &c.).

The Corporation of Stockton-on-Tees invite tenders for the supply of various stores for the Gas Department. [See advert. on p. 630.]

Meters.

The Corporation of Stockton-on-Tees invite tenders for the supply of gas meters. [See advert. on p. 630.]

Oil.

The Gas Department of the Borough of Bexhill invite tenders for the supply of gas oil. [See advert. on p. 630.]

Pipes.

The Rochdale Gas Department invite tenders for the supply and laying of 6000 yards of 12-in. cast-iron gas mains. [See advert. on p. 630.]

Purifiers.

The City of Bradford Gas Department invite tenders for the supply and erection of a set of cast-iron purifiers. [See advert. on p. 630.]

Retorts.

The Clacton-on-Sea Gas Department invite tenders for resetting retorts. [See advert. on p. 630.]

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Nov.* 26.

The London tar products market continues steady, and values are unchanged as follows:

Pitch, about 40s. to 42s. 6d. per ton.
Creosote, about 7d. per gallon.
Pure benzole, about 1s. 8d. per gallon.
Pure toluole, 1s. 11d. to 2s. per gallon.
Solvent naphtha, 95/160, about 1s. 6d. per gallon.
Pyridine, about 5s. per gallon.

Tar Products in the Provinces.

Nov. 26.

There is little or no alteration in the markets for tar products.

Pitch is still very quiet; but a little business is reported to have been done on the Continent at prices varying between 37s. 6d. and 40s.

In creosote there is very little business doing, and it is not likely there will be any considerable demand until the turn of the year.

Water-white products remain very firm indeed. There is no alteration in the market for crude carbolic acid or crystals carbolic.

Cresylic acid is steady, but the inferior grades are difficult to sell.

The average prices of gas-works products during the week were: Gas-works tar, 29s. to 34s. Pitch—East Coast, 37s. 6d. to 40s.* f.o.b. West Coast—Manchester, 32s. 6d. to 33s. 6d.; Liverpool, 34s. 6d. to 35s. 6d.; Clyde, 34s. 6d. to 35s. 6d. Toluole, naked, North, 1s. 5d. to 1s. 6d. nominal. Coal-tar crude naphtha, in bulk, North, 9d. to 10d. Solvent naphtha, naked, North, 1s. 1½d. to 1s. 2d. Heavy naphtha, North, 1s. to 1s. 0½d. Creosote, in bulk, North, liquid, 5⅛d. to 5¼d.; salty, 5¼d. to 5⅜d.; Scotland, 5¼d. to 5⅜d. Heavy oils, in bulk, North, 8¼d. to 8½d. Carbolic acid, 60 p.ct., 1s. 11d. to 2s. prompt. Naphthalene, £13 to £15; Salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

Benzole Prices.

The following are considered to be the market prices to-day:

		s. d.		s. d.	
Crude benzole		0 10	to	0 10½	per gallon at works
Motor	,,	1 4	,,	1 4½	,, ,, ,,
90 p.ct.	,,	1 7	,,	1 8	,, ,, ,,
Pure	,,	1 10	,,	1 11	,, ,, ,,

*Pitch—East Coast.—A Correction.

On p. 550 of last week's "JOURNAL," under Tar Products in the Provinces, the price of pitch on the East Coast was given as 37s. 6d. to 47s. f.o.b. This was a typographical error, which is regretted. The price quoted should have been 37s. 6d. to 40s.

Staff Dinner at Newcastle.—Under the chairmanship of Mr. E. H. Walton, the ninth annual dinner of the Newcastle-upon-Tyne and Gateshead Gas Company's chief office clerical staff who served with the Expeditionary Forces was held at the Royal Turk's Head Hotel, Grey Street, when a most enjoyable evening was spent.

Churnet Valley Gas Company.—The report of the Directors of the Churnet Valley Gas Company for the year ended Sept. 30 showed a profit on the revenue account of £1402, to which had to be added £1100 brought forward from the previous year, making a total of £2502. After the payment of debenture and bank interest, the net profit amounted to £2144; and the Directors recommended the payment of a dividend at the rate of 5 p.ct. After various other deductions for special purposes, the sum of £709 remained to be carried forward to the next account.

Rio de Janeiro Gas-Workers.—At a recent reunion of employees of the Rio de Janeiro Tramway, Light, and Power Company, members of over twenty years' service were presented to the new President of the Brazilian traction interests. More than 4000 employees of the Company were in attendance, and 656 were presented, with a total length of service exceeding 15,000 years. Both the oldest employee and the one with the longest service were from the Gas Department of the Company—the former being 95 years of age, and "still going strong," and the latter having served the Company for 53 years.

Reduction in Price of Gas at Shanklin.—The Shanklin Gas Company announce a reduction in the price of gas, on and after the readings of the meters at Christmas, to 1s. per therm in the inner area, and 1s. 1·33d. per therm in the outer area. This means that in the town of Shanklin the price will be 4s. 6d. per 1000 c.ft., and at Wroxall and the outlying districts 5s. per 1000 c.ft. If the proposed amalgamation of the Shanklin and Ventnor Companies takes place, the Directors of the Shanklin Company have given an undertaking that the price of gas at Ventnor will be immediately reduced by 1s. 7½d. per 1000 c.ft., with possible reductions to follow. The present price of gas at Ventnor is 7s. 6d. per 1000 c.ft.

Gas Exhibition at Melksham.—A Gas Exhibition, together with cookery demonstrations, organized by Messrs. R. & A. Main, Ltd., in co-operation with Mr. H. Hughes, of the Melksham Gas Light and Coke Company, was held in the Town Hall, Melksham, during the five days Nov. 12 to 16 inclusive. The exhibition was opened by Councillor P. Hughes; and appliances for lighting, heating, cooking, and hot water were displayed in operation. Cookery lectures were given by Miss A. M. Strick, M.C.A. During the period of the exhibition, the gas undertaking arranged for the conveyance, free of charge, of the inhabitants of the surrounding villages of Atworth, Whitley, and Beanacre, who wished to attend. It is understood that this display has resulted in an increase in the number of consumers of the gas undertaking.

Cheaper Gas for Kingston.—The Kingston Gas Company are reducing the price of gas throughout the whole area of their supply from the commencement of the Christmas quarter.

Fraud by Gas Employees at Fleetwood.—Two employees of the Fleetwood Gas Company, A. Wilson and J. E. Ainsworth, were each fined £2 at Fleetwood, on Nov. 20, for having broken into electric meters, and stolen over £6. It was stated that the locks on a number of meters had been broken open, and replaced in such a manner that the householders could not detect anything amiss.

Sliding-Scale Charges at Accrington.—The Accrington District Gas Board have adopted a new scale of charges on a sliding basis. The rate will decrease as the consumption increases, but there is an all-round reduction to domestic consumers of ⅛d. per therm, or 2½d. per 1000 c.ft., with further concessions according to the amount of consumption. The reduction to domestic consumers will vary between 2½d. and 4½d. per 1000 c.ft. The reduction comes into effect after the reading of the meters for the December quarter. Since the Board took over the supply of coke oven gas from the Altham Colliery, difficulties have been experienced owing to the presence of naphthalene in the gas. The Manager reports that the Colliery Directors are making progress with a new plant to remove the naphthalene, and it is hoped that all ground for complaint will shortly disappear.

South Suburban Gas Company's Bowls Club.—On Saturday, Nov. 17, the annual dinner of the Livesey Hall Bowls Club took place at the "Three Tuns" Hotel, Beckenham. After dinner, well-known artistes were engaged to give an entertainment. The Chairman, Mr. F. G. Gorman, A.M.Inst.C.E., proposed the toast of "The South Suburban Gas Company," and in doing so referred to the amicable and sportsmanlike spirit which prevailed in the Club, and the interest which the Board of Directors always took in the sport of the Company. Mr. Alex. Ross (Co-Partner Director) suitably responded. Mr. W. J. Spencer, the Secretary, in giving the toast of "The Bowls Club," referred to the excellent tradition of the Club. Mr. F. Reed responded. The toast of "The Chairman," which was proposed by Mr. R. G. Rix, was accorded musical honours.

Burnley Gas Staff Entertained.—Since the formal opening of the Oswald Street Works at Burnley, the mess rooms for the employees have been completed; and to mark the occasion, and to enable the employees to celebrate the opening of the works, the Chairman of the Gas Committee (Councillor Witham), the Gas Engineer (Mr. J. H. Clegg), and the Deputy Engineer (Mr. Howse) entertained the staff at tea, which was followed by a smoking concert. Mr. Clegg, after giving a brief account of the history of the Burnley undertaking, mentioned that, in looking over the wage books for 1858, he had found the names of men who had been with them up till last year. One of them then worked twelve hours a day for 18s. a week. The price of coal in those days was 7s. per ton. The price of materials then was 25 p.ct. less than it was now, but the price of gas was 5s., as against 2s. 11½d. to-day. Such progress, which gave cause for satisfaction, had been due to the enthusiasm of the gas industry as a whole, and the whole-hearted efforts of the workers in making such a serious study of the possibilities of the industry.

The tar plant of the bye-product works of the Bargoed Colliery was the scene of a small outbreak of fire on Nov. 21, but the flames were quickly extinguished by the colliery fire brigade.

At the monthly meeting of the Aberystwyth Rating Committee on Nov. 19, the Clerk reported that the gross assessment on the gas-works and mains had been increased from £200 to £2369 gross, and from £140 rateable value to £704.

The present rateable value of the Blackpool Gas-Works is £9020. The new value is £20,328. During the six weeks ended Nov. 21, the output of gas was 133 million c.ft., an increase of nearly 3½ millions on the previous year. During October, 124 new consumers were connected.

"We might have organized burglary or even murder," said a Shoeburyness Councillor, Mr. F. Desborough, when the Council considered the action of an employee in inadvertently cutting-off the gas supply. The Chairman assured the Council that the turning-off of the gas had only happened once, and was not likely to occur again.

At the engine house of Messrs. Denton Bros., Keighley, a recent outbreak of fire was caused by something coming into contact with a gas stove, which had been left alight to keep the engine warm. By some means the fire reached a large gas meter; and an explosion occurred. The gas was quickly turned off, however, and the fire subdued.

The Elland-cum-Greetland Gas Company, whose Engineer and General Manager is Mr. J. Bridge (Chairman of the Yorkshire District Gas Education Committee), recently offered prizes to local school children in the "B.C.G.A." Fairy Gas Competition, and secured an excellent entry. The prizes were distributed at the Company's new showrooms at 28, Southgate, Elland, by Mr. W. E. Dyson, C.C., the Chairman of the Company.

The Directors of the Plymouth and Stonehouse Gas Light and Coke Company have passed the following resolution: "That the best thanks of the Board be tendered to Viscount Astor for his able advocacy in the House of Lords of the claims of the gas industry to be freed from the obsolete legislation governing its operations, and for his valuable suggestions as to the procedure to be adopted to secure that end. The Board assures His Lordship that modern legislation would enable them not merely to keep their staff fully employed, but to relieve substantially the want of employment from which the city and its neighbourhood now suffers." Another resolution passed by the Board is as follows: "That the thanks of the Board be also tendered to Lady Astor for her kind promise of support in the House of Commons."

STOCK MARKET REPORT.

DEPRESSED conditions prevailed on the Stock Exchange throughout the week.

The Gas Market was again an exception to the general rule, and transactions were, if anything, more numerous. The only improvement in quotations of any importance, however, was the rise of 3 points in Uxbridge 5 p.ct. ordinary to 93-98. This stock is still undervalued; the yield on the last dividend of 6½ p.ct. being nearly £7 4s. p.ct. The rapid development of this Company's large area of supply makes the stock very attractive, and there are prospects of further capital improvement. It has been clearly evidenced in the past few years that "basic price" companies appeal to the gas investor; and we anticipate improvements in the values of the stocks of the Newcastle and Gateshead and the Wandsworth, Wimbledon, and Epsom Companies, in respect of which applications for "Basic Price and Dividend" powers are being made in the ensuing Session of Parliament.

Issue.	Shares.	When ex-Dividend.	Dividends. Prev. Hf.Yr	Dividends. Last Hf. Yr.	NAME.	Quotations. Nov. 23.	Rise or Fall on Week.	Transactions Lowest and Highest Prices.
£			%p.a	% p.a.				
171,978	Stk.	Aug. 30	5	5	Aldershot 5 p.c. max. C.	72—77	..	..
412,992	,,	,,	4	4	Do. 4 p.c. Pref.	68—71	..	..
1,551,868	,,	Sept. 27	7	7½	Alliance & Dublin Ord.	96—99	..	97½—98½
374,000	,,	July 12	4	4	Do. 4 p.c. Deb.	63—66	..	.. ..
522,554	,,	Aug. 30	7	7	Barnet Ord. 7 p.c.	114—117	..	..
300,000	1	Oct. 11	1/7½	1/4½	Bombay, Ltd.	20/—22/-	..	21/4½—21/9
170,000	10	Aug. 30	8½	8½	Bournemouth 5 p.c.	12½—13½	..	13½
500,050	10	,,	7	7	Do. B 7 p.c.	12½—12½	..	12½—12½
375,000	10	,,	6	6	Do. Pref. 6 p.c.	11—11½	+½	..
50,000	Stk.	July 12	3	3	Do. 3 p.c. Deb.	56—59	..	..
162,025	,,	,,	4	4	Do. 4 p.c. Deb.	75—78	..	77
857,900	,,	Aug. 30	7½	7½	Brighton & Hove 6 p.c. Con.	115—118	..	116½—117½
341,880	,,	,,	6½	6½	Do. 5 p.c. Con.	101—104	..	103½
1,227,500	,,	July 26	5	5	Bristol 5 p.c. max.	91½—92½a	..	..
885,000	,,	Sept. 27	7	8	British Ord.	114—117	..	115½—116½
100,000	,,	June 28	7	7	Do. 7 p.c. Pref.	114—117	..	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	74—77	..	..
200,000	,,	,,	5	5	Do. 5 p.c. Red. Deb.	95—98	..	..
100,000	10	May 24	8	8	Cape Town, Ltd.	8—9	..	..
100,000	10	Oct 25	4½	4½	Do. 4½ p.c. Pref.	6¾—7¼*	..	..
150,000	Stk.	June 28	4½	4½	Do. 4½ p.c. Deb.	78—78	..	..
626,860	,,	July 26	6	6	Cardiff Con. Ord.	97—100	..	..
287,880	,,	June 28	7½	7½	Do. 7½ p.c. Red. Deb.	100—103	..	..
157,150	,,	Aug. 16	6½	5	Chester 5 p.c. Ord.	88—93b	..	..
79,185	1	Oct. 11	†2/-	†2/-	Colombo Ltd. Ord.	39/—41/-	..	..
24,495	1	,,	1/4½	1/4½	Do. 7 p.c. Pref.	20/6—22/6	..	..
375,402	1	Oct. 11	1/9½	1/9½	Colonial Gas Assn. Ld. Ord	23/6—25/6	..	..
187,848	1	,,	1/7½	1/7½	Do. 8 p.c. Pref.	21/—23/-	..	..
3,073,280	Stk.	July 26	7	8	Commercial Ord.	98—101	..	99½—100½
475,000	,,	June 14	8	8	Do 8 p.c. Deb.	57—60	..	60
800,000	,,	Sept. 27	11	11	Continental Union, Ltd.	37—40	+1	36—38½
200,000	,,	,,	7	7	Do. 7 p.c. Pref.	90—95	..	..
187,560	,,	Aug. 16	7	7	Croydon sliding scale	110—113	..	..
468,100	,,	,,	5	5	Do, max. div.	84—87	..	86½
493,270	,,	Aug. 16	10	7	Derby Con.	115—120c	..	..
55,000	,,	June 28	4	4	Do. Deb.	71—78c	..	..
939,000	,,	Aug 30	5	5	East Hull Ord. 5 p.c.	75—78	..	..
1,002,180	10	Sept. 13	†6	†4	European, Ltd.	8 9	..	8—8½
2,703,480	Stk.	July 26	5/1/4	5½	Gas Light & Coke 4 p.c. Ord.	18/9—19/3f	..	18/7½—19/-
2,600,000	,,	,,	8½	8½	Do. 8½ p.c. max.	62½—64½	..	63½—64½
4,187,020	,,	,,	4	4	Do. 4 p.c. Con. Pref.	76—79	..	77½—78½
5,602,620	,,	June 14	3	3	Do. 3 p.c. Con. Deb.	60½—62½	..	60—61½
181,815	,,	,,	6	6	Do. 6 p.c. Br'tf'd Rd. Db.	104 107	..	..
1,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb.	99—101	..	..
42,000	,,	—	7½	7½	Do. 7½ p.c. Ilford Deb.	..	..	..
62,500	,,	Aug. 30	6½	7	Hastings & St L. 5 p.c. Conv	95—100	..	..
268,740	,,	,,	5½	6½	Do. 8½ p.c. Conv.	75 80	..	77
70,000	10	Oct 11	†10	†10	Hongkong & China, Ltd.	18 14	..	..
178,200	Stk.	Aug 30	5	5½	Hornsey Con. 8½ p.c.	88—91	..	..
1,976,000	,,	Nov. 8	10	10	Imperial Continental Cap.	167—170	−1	167—169
238,180	,,	Aug 16	8½	8½	Do. 8½ p.c. Red. Deb.	67—69	..	..
285,242	,,	Aug 16	7	7½	Lea Bridge 6 p.c. Ord.	98 101	..	..
2 145,967	,,	Aug. 16	5½	5½	Liverpool 5 p.c. Ord.	90 91b	..	..
600,000	,,	Sept 27	7	7	Do. 7 p.c. Red. Pref.	101—102b	..	..
168,786	,,	Aug. 16	8	9	Maidstone 5 p.c. Cap.	120 -125	..	..
63,480	,,	June 14	3	3	Do. 3 p.c. Deb.	55—58	..	..
10,000	5	June 14	†8	†8	Malta & Mediterranean	5½ 6	..	..
541,920	Stk.	Nov. 22	†7	†5	Montevideo, Ltd.	95—97*	−2	9⅞
2,061,315	,,	Aug. 16	5	5	Newcastle & Gateshead Con.	16/—16/6d f	—/3	..
360,929	,,	,,	4	4	Do. 4 p.c. Pref.	70 71d	−½	..
691,705	,,	June 28	8½	8A	Do. 8½ p.c. Deb.	69½—70½d	..	..
131,780	,,	Aug. 30	6/18/0	7/1.0	North Middlesex 6 p.c. Con.	102—107	..	..
300,000	,,	Nov. 22	7	9	Oriental, Ltd.	112 -115*	−3	116—117
188,190	,,	June 28	7½	7½	Plym'th & Ston'house 5 p.c.	110—113	..	..
414,500	,,	Aug. 30	7½	7½	Portsm'th Con. Stk. 4p.c. Std.	101—104	..	..
336,782	,,	,,	5	5	Do. 5 p.c. max.	79 - 82	..	..
2,334,464	1	—	—	—	Primitive Ord.	23/—25/-	..	23/4½—24/-
244,500	100	June 1	4	4	Do. 4 p.c. Red. Deb.	91—94	..	..
695,000	Stk.	July 26	4	4	Do. 4 p.c. Red. Deb. 1911	78—80	..	..
416,345	,,	June 28	4	4	Do. 4 p.c. Cons. Deb.	78—80	..	..
160,000	10	Sept 27	6	6	San Paulo 6 p.c. Pref.	8'—8½	..	..
270,000	Stk.	Aug. 30	6	6½	Sheffield A	104—105e	..	..
419,988	,,	,,	6	6½	Do. B	104—105e	..	..
1,047 000	,,	,,	6	6½	Do. C	104—105e	..	..
90,000	10	June 14	†3	†4	South African	4—6	..	..
6,609,895	Stk.	July 26	7½	5	South Met. Ord.	106½ 108½	..	107—107½
500,000	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	110—113	..	112½—113
1,895,445	,,	July 12	3	3	Do. 3 p.c. Deb.	59—61	..	594—61
784,000	,,	Sept 13	6½	6½	Do. 6½ p.c. Red. Db.	100 -102	..	101½—102
91,500	,,	Aug 16	8½	8½	South Shields Con.	09 -110d	..	..
1,343,795	,,	July 26	6½	6½	South Suburban Ord. 5 p.c.	108—111	..	109½—110
868,887	,,	June 28	5	5	Do. 5 p.c. Deb.	98 101	..	100
647,740	,,	Aug 30	5	5	South'mpton Ord. 5 p.c. max	77—79	..	..
121,275	,,	June 28	4	4	Do. 4 p.c. Deb.	72—75	..	..
260,000	,,	Aug 30	7	7	Swansea 7 p.c. Red. Pref.	101—103	..	..
300,000	,,	June 28	6½	6½	Do. 6½ p.c. Red. Deb.	101—103	..	..
120,000	,,	July 26	7½	8	Tottenham District A 5 p.c.	117—122	..	..
882,275	,,	,,	6½	6½	Do. B 3½ p.c.	100—103	..	101½—102½
150,000	,,	,,	5½	5½	Do. 5½ p.c. Pref.	96—99	..	..
181,255	,,	June 14	4	4	Do. 4 p.c. Deb.	76—79	..	..
289,094	,,	Aug 30	6⅝	6⅝	Uxbridge, Maidenhead, & Wycombe 5 p.c.	93—98	+3	96—96½
84,880	,,	,,	5	5	Do 5 p.c. pref.	87—92	..	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	,,	July 12	8½	8½	Wandsworth A 5 p.c.	130—135	..	..
256,686	,,	,,	7	7½	Do. B 3½ p.c.	113 -118	..	115½
489,555	,,	,,	5/19/0	6½	Do. C and New	98—103	..	101½
852,000	,,	,,	6⅝	6⅝	Do. Wimbledon 5 p.c.	107—112	..	109½
98 000	,,	,,	7½	7½	Do. Epsom 5 p.c.	115 -120	..	..
300,000	,,	,,	5	5	Do. 5 p.c. Pref	88 91	..	..
84 416	,,	June 28	3	3	Do. 3 p.c. Deb.	57 60	+1	574—59
281 748	,,	,,	4	4	Do. 4 p.c. Deb.	76—79	+1	76—78
207,500	,,	,,		5	Do. 5 p.c. Deb.	98—100	..	99—100

Quotations at:—*a*—Bristol. *b*.—Liverpool. *c*.—Nottingham. *d*.—Newcastle. *e*.—Sheffield. *f*—The quotation is per £1 of Stock. * Ex div. † Paid free of income-tax. ‡ For year.

The following transactions were recorded during the week:

On Monday, Alliance and Dublin 97½, Bombay 21s. 4½d., 21s. 6¾d., Bournemouth "B" 12¾, Bristol 5 p.ct. max. 91½, Commercial 100½, Continental Union 38, 38½, Gas Light and Coke 18s. 7½d., 18s. 9d., 18s. 10½d., 18s. 11d., 18s. 11¼d., 19s., 3½ p.ct. max. 64, 4 p.ct. pref. 77½, 77⅝, 77½, 77⅝, 77¾, 8, 3 p.ct. deb. 60, 61, Liverpool 7 p.ct. pref. 101½, 102½, Primitiva 23s. 6d., 23s. 7½d., 23s. 9d., 23s. 10½d., 24s., South Metropolitan 107¼, 107¾, 6 p.ct. pref. 112½, 113, 3 p.ct. deb. 60½, 6½ p.ct. deb. 101½, Tottenham "B" 101½, 102¼, Wandsworth 4 p.ct. deb. 76, 77½. Supplementary prices, Gas Light and Coke 5 p.ct. deb. 102, 102¼, Grays and Tilbury "B" 10¼, Liverpool 5 p.ct. 90⅞, 91½, Wakefield 5 p.ct. 71½.

On Tuesday, Alliance and Dublin 98⅛, Bournemouth 5 p.ct. 13½, "B" 12½, 12⅝, 12¾, Brighton and Hove 6 p.ct. 116½, 116¾, Commercial 99½, 3 p.ct. deb. 60, Continental Union 36, European 8½, 8¼, Gas Light and Coke 18s. 9d., 18s. 10½d., 19s., 3½ p.ct. max. 64, 4 p.ct. pref. 77⅜, 77½, 78, Imperial Continental 167, 168, Liverpool 7 p.ct. pref. 102½, Montevideo 97½, Newcastle 4 p.ct. pref. 72, Primitiva 23s. 9d., 23s. 10½d., South Metropolitan 107, 107¼, 6½ p.ct. deb. 101½, South Suburban 5 p.ct. 109¼, 109½, Tottenham "B" 101⅝, 102, 102½, 102⅝, 102½, 102⅝, 102⅞, Wandsworth (Wimbledon 5 p.ct.) 109½. Supplementary prices, Aldershot 4 p.ct. deb. 76⅝, 76¾, Eastbourne 3½ p.ct. "B" 105, 105½, Gas Light and Coke 5 p.ct. deb. 102, 102¼, Southend original 93, 93½.

On Wednesday, Bombay 21s. 6d., 21s. 9d., Bournemouth 7 p.ct. 12 7/16, 4 p.ct. deb. 77, Bristol 5 p.ct. 91⅞, British 115½, Commercial 3 p.ct. deb. 60, Continental Union 37½, Croydon max. div. 85½, Gas Light and Coke 18s. 7½d., 18s. 9d., 19s., 4 p.ct. pref. 78, 78½, Hastings and St. Leonards 3½ p.ct. 77, Imperial Continental 167, 168, 169, Newcastle 4 p.ct. pref. 71½, 72, Oriental 116, 117, Primitiva 23s. 4½d., 23s. 6d., 23s. 9d., 23s. 10½d., 24s., South Metropolitan 6 p.ct. pref. 113, 3 p.ct. deb. 60, 6½ p.ct. deb. 102, South Suburban 5 p.ct. 110, 5 p.ct. deb. 100, Uxbridge 5 p.ct. 96, 96½. Supplementary prices, Cheltenham 5 p.ct. 73¾, Eastbourne 3½ p.ct. "B" 104, 105, Gas Light and Coke 5 p.ct. deb. 102, 102¼, Leatherhead 5 p.ct. 10 5/16, 10⅝, Liverpool 5 p.ct. 90½, 91, Tottenham 7½ p.ct. 103¼.

On Thursday, Brighton and Hove 6 p.ct. 116½, 117½, 5 p.ct. 103½, British 116½, Gas Light and Coke 18s. 9d., 19s., 3½ p.ct. max. 63¾, 64, 64¼, 4 p.ct. pref. 78½, 3 p.ct. deb. 61, Imperial Continental 167¼, 168¾, Newcastle 4 p.ct. pref. 71½, Primitiva 23s. 6d., 23s. 7½d., 23s. 10½d., 24s., South Metropolitan 107, 107½, 6 p.ct. pref. 112¼, 3 p.ct. deb. 59½, 60, 61, Wandsworth 3 p.ct. deb. 59, 4 p.ct. deb. 77½, 78, 5 p.ct. deb. 100. Supplementary prices, Bournemouth new 6 p.ct. pref. £11 5s. 6d., Brighton and Hove 4 p.ct. deb. 77, Gas Light and Coke 5 p.ct. deb. 1952-57, 102, 102¼, Liverpool 5 p.ct. 90½, 91.

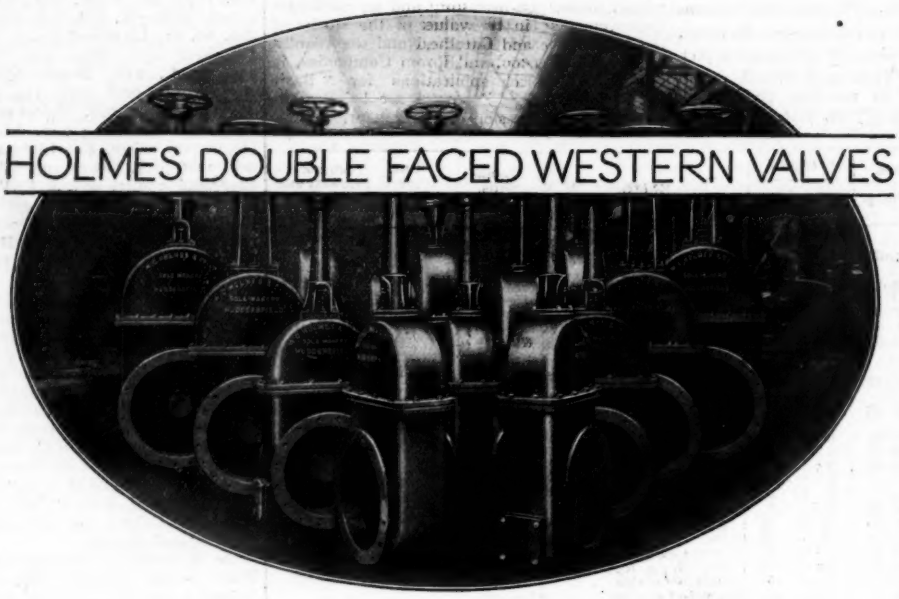
On Friday, Bournemouth "B" 12¼, Commercial 100½, Continental Union 38, European 8, 8½, 8¼, Gas Light and Coke 18s. 8½d., 18s. 9d., 18s. 9⅜d., 18s. 10½d., 19s., 4 p.ct. pref. 78⅜, 3 p.ct. deb. 60½, 61, 61½, Imperial Continental 167, 167¾, 168, Liverpool 7 p.ct. pref. 101½, Primitiva 23s. 4½d., 23s. 6d., South Metropolitan 107, 6 p.ct. pref. 112⅜, 3 p.ct. deb. 60, 61, Wandsworth "B" 115½, "C" 101½, New 101½, 3 p.ct. deb. 57½, 5 p.ct. deb. 99, 99½. Supplementary prices, Bristol 4 p.ct. deb. 75½, 4 p.ct. new deb. 75½, Gas Light and Coke 5 p.ct. deb. 1952-57 102, 102¼, Grays and Tilbury "B" 10¼, Liverpool 5 p.ct. 91½.

The monetary position was comparatively easy at the close of the week. The general rate for both old and new loans was 3⅜ p.ct., but balances were available towards the close down to 3 p.ct. Discount quotations were unaltered, and Treasury Bills were allotted at £4 7s. 9·21d. p.ct., showing a fall of 3·26d. p.ct., as compared with the average rate for the previous week.

The chief interest in the Foreign Exchange Market was a fall in the German Exchange, which closed at 20.34⅜.

Silver, with China selling, declined to 26½d. per oz., and Gold was unchanged at 84s. 11½d. per oz.

The Bank Rate is 4½ p.ct., to which it was reduced from 5 p.ct. on April 21, 1927. The Banks' deposit rate is 2½ p.ct., and the deposit rates of the discount houses are 2½ p.ct. at call and 2⅝ p.ct. at notice.



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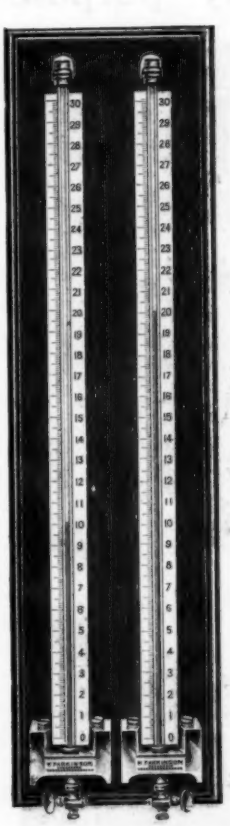

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